DERUYTER CSD

2024 CAPITAL PROJECT

AM Project No. 23062

PROJECT MANUAL

Volume 2

Divisions 02 – 33

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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. 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 recycled.

1.3 DEFINITIONS

A. Remove, Demolish, Demo: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner, ready for reuse. Include fasteners or brackets needed for reattachment elsewhere.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and 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 PRE-DEMOLITION MEETINGS

A. Pre-demolition Conference: Attend conference at Project site. Review methods and procedures related to selective demolition including, but not limited to, the following:
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. 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 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.
6. Means of protection for items to remain and items in path of waste removal from building.

C. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

D. Pre-demolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by selective demolition operations.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: After selective demolition is complete, submit a final list of items that have been removed and salvaged.

B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

C. 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.

D. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.8 QUALITY ASSURANCE

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

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

1.9 PROJECT 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.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. On-site storage or sale of removed items or materials is not permitted.

E. 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 HAZARDOUS MATERIALS

A. General:
1. Hazardous materials are known to be present at some buildings as listed below. 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.
2. Hazardous material remediation is specified in Section 02 8213
3. If other suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.

B. Locations where Hazardous Materials are present as a part of the Work:
1. Refer to Division 02 Section ASBESTOS ABATEMENT.

C. Other buildings:
1. It is not expected that hazardous materials will be encountered in the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.

D. Lead:
1. Refer to Division 02 Section LEAD SAFE WORK PRACTICES
2. Contractors should assume lead based paint on ALL buildings built prior to 1978. The contractor should have in place a Lead Compliance Program in accordance with OSHA 29 CFR 1926.62, which addresses worker protection, etc. Contractors performing work in a child occupied facility (schools, etc.) as defined in USEPA RRP regulation (40 CFR 745, Subpart E) shall comply with the requirements of that regulation.

1.11 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties. Notify warrantor before proceeding. 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.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Engage a professional engineer, currently licensed in the State of New York, to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
   1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

F. Survey of Existing Conditions: Record existing conditions by use of measured drawings, preconstruction photographs, and/or preconstruction videotapes.
   1. 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.

3.2 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 indicated 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. 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.
   3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated 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.
      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.

C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 PREPARATION

A. 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.
   1. Comply with requirements for access and protection specified in Division 01 Section TEMPORARY FACILITIES AND CONTROLS.

B. Temporary Facilities: 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 Division 01 Section TEMPORARY FACILITIES AND CONTROLS

C. Temporary Shoring: 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.

3.4 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, to minimize disturbance of adjacent surfaces. 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 fire watch during and a minimum of thirty (30) minutes after flame cutting operations in accordance with current Fire Code of New York State; § 2604.2 - Fire Watch. Code Enforcement Officer or responsible manager representing Owner may extend time period based on hazards being performed.
   5. Maintain adequate ventilation when using cutting torches.
   6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
   7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
   8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
   9. Dispose of demolished items and materials promptly. Comply with requirements in Division 01 Section CONSTRUCTION WASTE MANAGEMENT.

B. 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 on-site or off-site.
   5. Protect items from damage during transport and storage.

C. 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.

D. 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.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

D. Resilient Floor Coverings: Remove floor coverings and adhesive, and prepare substrates for new floor coverings, according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings" and its Addendum.
   1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.
   2. ALL FLOORING: In general, or unless otherwise noted, it is the intent to remove all existing flooring and adhesives where new flooring is scheduled to be installed.
   3. Do not use methods requiring solvent-based adhesive strippers.

E. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. See Division 07 Section ROOFING for new roofing requirements.
   1. Remove existing roof membrane, flashings, copings, and roof accessories.
   2. Remove existing roofing system down to substrate.

F. Air Conditioning Equipment: Remove equipment without releasing refrigerants.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
   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 Division 01 Section CONSTRUCTION WASTE MANAGEMENT.

B. Burning: Do not burn demolished materials.

3.7 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 02 4119

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The extent of asbestos-containing material (ACM) to be removed and disposed under this project is indicated on the Hazardous Material Removal Plans and in this Section. The work shall be conducted in accordance with all applicable codes, rules, and regulations including, but not limited to, New York State Industrial Code Rule 56 (Cited as 12 NYCRR Part 56).

1. The abatement work areas are located in the DeRuyter Central School District main school building. The Abatement Contractor shall refer to, at a minimum, the Prime Contractors', Construction Manager's and Architect's Renovation Drawings as well as the Hazardous Materials Survey, found in the "Information for Bidders", for a representation of the general layout of the anticipated work areas and the scope of asbestos removal and disposal specified at each work area.

2. The work consists of the removal and disposal of asbestos containing materials as identified below. Dispose of all removed ACM material and debris as asbestos-contaminated debris in accordance with applicable regulations.

B. The scope of asbestos abatement identified for this project is summarized below:

Table 1 – DeRuyter Central School District

LOCATION	ACM MATERIAL	APPROXIMATE QUANTITY
DeRuyter Main School Building	Boiler Abatement/Demolition	600 SF
	Floor Tile & Mastic	240 SF
	Pipe Insulation	3 LF & 2 Fittings
	Pipe Fitting Insulation in Wall	10 Fittings
	Chalkboard Mastic	50 SF

Note:

1. The quantities indicated above are estimates. Accordingly, variations (±20%) in quantities of ACM within the limits of containment are to be expected and shall be considered as having no impact on contract price or schedule. The *Abatement Contractor must satisfy himself as to the quantities and conditions of all asbestos-containing materials required to be removed and disposed and base his contract bid accordingly. All asbestos-containing materials slated for removal shall be removed in their entirety down to a clean substrate. Any and all underlying materials such as floor leveling compounds, underlayment, vapor barriers and other materials and/or debris shall be removed completely and disposed of. Floor tile adhesive shall be removed by mechanical means only, solvent use is prohibited.*

2. For the purpose of bidding, the abatement contractor shall provide a bid that includes all labor, expenses, fees, insurance, bonding, disposal, overhead and profit to complete the removal and disposal of materials specified herein. The abatement contractor shall also submit unit pricing for removal of ACM materials within the scope of work that may not have been identified during the design phase.

3. Any discrepancies in quantities or locations noted by the contractor in excess of the above percentage must be noted in writing and given to the building owner before materials are removed so quantities can be independently verified:

C. General Conditions

1. The Owner will make necessary arrangements prior to the start of asbestos abatement work to remove moveable objects (i.e., equipment, appliances, desks, chairs, casework, etc.) from proposed work areas, hallways, offices, foyers, and other areas where ACM is scheduled to be removed, as necessary, to provide the Abatement Contractor with sufficient access to specified work areas to construct required critical barriers which adjoin the work areas.

2. The asbestos abatement work shall be conducted by a New York State licensed asbestos abatement contractor in accordance with all applicable codes, rules, and regulations including, but not limited to, New York State Industrial Code Rule 56 that apply to the work. In lieu of strict compliance with Industrial Code Rule 56, the Abatement Contractor may, at his own expense, obtain and use a site-specific variance to conduct the asbestos abatement work. *The site-specific variance shall be prepared by a NYSDOL certified Project Designer and will be subject to prior review and approval by the Owner or designated representative, and provided that the site-specific variance petition process does not delay the start or finish of the asbestos abatement work as scheduled.*

3. The Abatement Contractor shall employ only New York State Department of Labor (NYSDOL) certified Asbestos Supervisors and Handlers. The Contractor shall provide the appropriate quantity of certified personnel to work as many shifts and as many hours as needed to complete the work within the specified time period as scheduled.

4. The Contract Drawings indicate the extent of the removal and disposal and is to be used as a guideline. *The Abatement Contractor shall field verify to his satisfaction all quantities, locations, and conditions of ACMs to be removed and disposed under this project.* The Abatement Contractor shall review all architectural drawings as to the extent, location and configuration of the abatement work areas. Such as, but not limited to, a detailed representation of the general layout of the site buildings, building access, the extent of asbestos removal specified per work area, and ancillary machinery or equipment (i.e., mechanical, electrical, landscaping, etc.) located within each specific work area.

5. The Abatement Contractor shall conduct or otherwise provide for personal air sampling of abatement personnel employed on the project, including daily 8-hour Time-Weighted Average (TWA) and 30-minute Short Term Excursion Limit (STEL) air sampling, as required by OSHA 29 CFR Part 1926.1101. *Personnel 8-hr. TWA and 30-min. STEL samples shall be analyzed for asbestos fibers by Phase Contrast Microscopy (PCM) and the results shall be conspicuously posted at the project site within 72-hours of collection.*

6. The Abatement Contractor shall protect architectural finishes, landscaping, and equipment outside the abatement work area and all adjacent non-work areas from damage and, if any damage occurs, the Contractor shall be held liable for all costs related to the repair, restoration, or replacement of the damaged fixtures or structures at no cost to the Owner.

D. Asbestos abatement activities shall include:

1. Removal and disposal of ACM as identified on the hazardous materials contract drawings. Dispose of all removed ACM material and associated debris as asbestos-contaminated debris.

2. Furnish all labor, materials, licenses/permits, facilities, equipment, services, employee training and testing necessary to perform the work required in accordance with these specifications, the latest regulations from the U.S. Environmental Protection Agency (USEPA), the Occupational Safety and Health Administration (OSHA), the State of New York, the recommendations of the National Institute of Occupational Safety and Health (NIOSH), Standard 241 of the National Fire Protection Association (NFPA) and any other applicable federal, state, and local government regulations that apply to this project.

3. The work specified herein shall be performed by competent persons trained, knowledgeable and qualified in state-of-the-art technologies of asbestos abatement, handling, and the subsequent cleaning and disposal of contaminated areas. An accredited asbestos abatement supervisor shall be on-site during all phases of asbestos abatement activities.

1.2 SUBMITTALS

A. Approval by the Owner is required of the experience of the Abatement Contractor PRIOR TO CONTRACT AWARD and will be based upon submission by Contractor evidence of the following. These items shall be submitted to the Owner with the Bid Documents at the time of bid receipt.

1. The Contractor shall submit a listing of projects indicating skills and experience with all phases of abatement work as evidenced through participation in at least five asbestos abatement projects of comparable complexity with this project. Include a list of project/location names, project-monitoring firm and phone numbers of references.

2. The Contractor shall submit a *notarized statement*, signed by an officer of the company, containing the following information:

a. A record of any citations, penalties, orders to comply, notices of deficiency, or notices of violations issued by Federal,

State, or local regulatory agencies related to asbestos abatement activities. Include projects, dates and resolutions.

b. A list of penalties incurred through non-compliance with asbestos project specifications including liquidated damages, overruns in scheduled time limitations and resolutions.

c. Situations in which asbestos related contracts have been terminated including projects, dates and reasons for terminations.

d. A listing of any asbestos-related legal proceedings/claims in which the Abatement Contractor (or employees scheduled to participate in this project) has participated or are currently involved. Include descriptions of role, issue and resolution to date.

B. Prior to the start of the asbestos abatement work, the Abatement Contractor shall submit the following Pre-Abatement Submittals at least 10 days prior to the pre-construction meeting. The Owner or Owner's representative will review, for approval, the Contractors submittal package prior to commencing asbestos abatement work. *Asbestos abatement work shall not commence until approval of the Pre-Abatement Submittal package has been obtained*.

1. Contractor's NYSDOL Asbestos License.

2. Asbestos Work Plan:

a. Submit a detailed plan of the work procedures to be used in the removal and disposal of ACM and asbestos-contaminated debris. The work plan shall include location of control areas, layout of decontamination chambers, sequencing of asbestos related work, negative air pressure filtration system plan, disposal plan, type of wetting agent, asbestos sealer to be used, personal air monitoring program, and a detailed description of the method to be employed in order to control pollution, including but not limited to emergency procedures for fire and medical emergencies. This plan must be approved by the Owner prior to the start of any asbestos work.

b. Submit a negative air pressure filtration system plan, *if applicable to the project*, which includes method of providing air into the work area, the anticipated location of the high efficiency purified air (HEPA) filtration system, anticipated HEPA filtration exhaust location(s), negative air pressure to be maintained in the work area, the method to control this pressure, and provision for maintaining effectiveness of the pre-filters.

c. Submit a copy of the forms to be used for maintenance of waste shipment records in compliance with USEPA National Emissions Standards for Hazardous Air Pollutants (NESHAPS) regulations.

d. Submit manufacturer's certification that vacuums, filtration units, and other equipment required to contain airborne asbestos fibers conform to HEPA filtration requirements.

3. Waste Transporter Permit:

a. Submit a Waste Transporter Permit issued by the New York State Department of Environmental Conservation (NYSDEC) pursuant to 6 NYCRR Part 364 specifically for transporting asbestos waste and debris to an approved treatment, storage, or disposal facility. *The permit shall include the name and location of each treatment, storage, or disposal facility, and a list of vehicles permitted to haul/transport asbestos waste in New York State.*

4. Wastewater Discharge Permit:

a. Submit, *if applicable to the project*, a Wastewater Discharge Permit issued by the County or local enforcement/permitting agency to discharge filtered wastewater to the municipal sanitary sewer system.

b. If such a permit is not issued, the Abatement Contractor shall submit a letter stating the procedure and intent for handling and disposing of asbestos containing wastewater generated during the asbestos project.

5. Work Schedule:

a. The Abatement Contractor shall submit written notification to the Owner of his intent to start work at least 10 days in advance. *The Contractor shall not start work or post a notification until authorization to proceed is received from the Owner.*

b. The Abatement Contractor shall submit a bar-chart schedule, or similar, indicating each significant asbestos abatement phase and associated activity.

6. Emergency Telephone Numbers:

   a. Submit the names and telephone numbers of personnel (i.e., Supervisor, Project Manager, etc.) to contact in the event of an emergency. A representative of the Contractor shall be available at all times during the course of the project.

7. Asbestos Project Notifications:

   a. The Abatement Contractor shall submit, *if applicable to the project*, notification to:

U.S. Environmental Protection Agency - Region II
Air & Hazardous Material Division
Room 1011
26 Federal Plaza
New York, New York 10278

   b. The Abatement Contractor shall submit, *if applicable to the project*, notification to:

NYS Department of Labor
Division of Safety & Health
Asbestos Control Bureau
State Office Building Campus
Building 12 - Room 454
Albany, New York 12240

   c. The Abatement Contractor shall prepare, submit and post a written notification to occupants of the site buildings for the asbestos abatement work, and post such notifications where the work will be performed in accordance with Industrial Code Rule 56.

   d. The Abatement Contractor shall prepare a written notification to the local fire/rescue department for the asbestos abatement work.

8. Legible copy (front and back) of each asbestos abatement supervisor's Asbestos Handling Certificate anticipated to be working at the project. *An asbestos abatement supervisor shall be on site during all abatement activities.*

9. Legible copy (front and back) of each asbestos abatement project personnel's Asbestos Handling Certificate who is anticipated to be working on the project.

10. Legible copy of each asbestos abatement project personnel anticipated to be working at the project of having been trained in an EPA approved Supervisor or Handler course within the past 12 months (DOSH 2832).

11. Legible copy of each asbestos abatement project personnel anticipated to be working at the project of having been fit-tested within the past 12 months for using a negative-pressure air purifying respirator equipped with a high efficiency particulate air (HEPA) filter cartridges.

12. Legible copy of each asbestos abatement project personnel anticipated to be working on the project of having been examined by a qualified physician within the past 12 months, being capable of wearing respiratory protection and able to perform asbestos abatement work.

13. The Abatement Contractor shall submit a site-specific variance petition, *if applicable to the project*, prepared by a NYSDOL certified Project Designer, and proof of approval issued by the NYSDOL.

14. Submit Safety Data Sheets (MSDS) for all materials and equipment as specified in this Section or otherwise proposed for use on the project by the Abatement Contractor.

C. Upon completion of the asbestos abatement work and as a condition of acceptance, the Contractor shall submit the following Post-Abatement (Project Close-out) Submittals:

   1. All waste manifests and landfill receipts detailing disposal of all asbestos waste generated by the work at the Project.

2. All certified analytical results of all personal air samples collected as required by OSHA to document the 8-hour TWA and 30-minute STEL concentrations of asbestos fibers in the breathing zone of the asbestos abatement project personnel.

3. A legible copy of the Abatement Contractor's project logbook containing the day-to-day record of personnel entering the project site as well as the regulated asbestos work area(s), and any significant events occurring during the project.

1.3 QUALITY ASSURANCE

A. The Abatement Contractor shall assume full responsibility for compliance with all applicable codes, rules, regulations, and standards pertaining to asbestos work practices, transport and disposal of asbestos waste, and protection of workers, visitors, and public from the work site. The Abatement Contractor shall comply with all aspects of the Asbestos Hazard Emergency Response Act (AHERA) regulations as governed by the USEPA that are applicable to the project.

B. Except to the extent that more stringent requirements are written directly into the Contract Documents, the following regulations shall have the same force and effect as if copied directly into the Contract Documents, or as if copies were bound herewith:

1. OSHA 29 CFR Part 1910.134 - Respiratory Protection
2. OSHA 29 CFR Part 1910.145 - Accident Prevention
3. OSHA 29 CFR Part 1926.1101 – Asbestos
4. OSHA 29 CFR Part 1910.1001 – Asbestos
5. OSHA 29 CFR Part 1926.2 – Variances from Health and Safety Standards
6. OSHA 29 CFR Part 1910.1200 - Hazard Communication
7. OSHA 29 CFR 1926.1200 – Confined Spaces in Construction
8. USEPA 40 CFR Part 61 - Asbestos National Emission Standards Hazardous Air Pollutants
9. USEPA 40 CFR Part 763 – Asbestos including AHERA

C. New York State regulations, which govern asbestos abatement, hauling, and disposal of asbestos waste materials include, but are not limited to, the following:

1. Official Compilation of Codes, Rules and Regulations of the State of New York, cited as 12 NYCRR Part 56.

2. NYSDOL Article 30 of the New York State Consolidated Laws, Asbestos or Products Containing Asbestos; Licensing, as amended and effective July 16, 1989.

3. NYSDEC Title 6 Part 364 of the New York State Official Compilation of Codes, Rules and Regulations, cited as 6 NYCRR Part 364.

4. NYSDOH Title 10 of the New York State Official Compilation of Codes, Rules and Regulations, cited as 10 NYCRR Part 73, the Asbestos Safety Program Requirements.

D. Consult with the local fire/rescue department in the preparation of the Emergency Procedures Plan for fire and medical emergencies. Notify the local fire/rescue department at least seven days prior to the start of abatement work. The Plan should, at a minimum, establish a system for alerting project personnel of fire or other hazards that require escape routes, development of an assigned meeting place, development of a building floor plan showing work areas and emergency exists, mark arrows on floor and/or walls in the work areas to show all emergency exits, provide an on-site telephone for emergency notification to authorities, provide a person who is trained in First Aid, and chemical fire extinguishers on site for emergencies. In case of emergency due to fire, shut off all negative air machines during the fire.

E. The Project Monitor is authorized by the Owner to oversee all removal work, interpret all procedures and enforce all provisions of the Contract Documents pertaining to asbestos removal and disposal. The Project Monitor is authorized to stop work if, in their judgment, there is substantial non-compliance with Contract Documents, or there is a situation of serious health risk to workers or occupants due to the performance of work by the Contractor. Such stop work order shall be effective immediately and remain in effect until corrective measures have been taken and the situation has been remedied to the satisfaction of the Owner. *Standby time required to resolve such situations shall be at the Abatement Contractor's own expense.*

F. Upon completion of asbestos abatement work, the Project Monitor shall submit to the Owner a full report of daily job events.

G. Negative Air Pressure Filtration System Monitoring shall include the following:

1. Continuous 24-hour per day monitoring of pressure differential relative to adjacent unsealed areas shall be performed by automatic recording instruments, *if applicable to the project*.

2. Pressure differential recordings for each day the negative air pressure filtration system shall be reviewed by the Project Monitor, *if applicable to the project*. The Project Monitor shall immediately notify the Abatement Contractor and the Owner of any variance in the pressure differential, which could cause exposure of adjacent unsealed areas to asbestos fiber contamination.

1.4 PRE-BID MEETING

A. Bidders are encouraged to attend a pre-bid meeting. Refer to Notice to Bidders for the designated time and location of the pre-bid meeting. Attendance at this meeting by the Bidders or his qualified representative will be recorded.

B. At the time of bid opening, each bidder shall acknowledge that he has investigated and satisfied himself as to:

1) Conditions affecting scope of work, including but not limited to, physical condition of the site, handling and storage of tools and materials, access to utilities.

2) Characteristics and quantity of all materials and obstacles encountered in so far as this information is reasonably ascertainable from an inspection of the site.

3) Condition, location and extent of ACM to be removed and disposed. The Owner is not responsible for any conclusions or interpretations made by the Contractor.

C. The asbestos abatement work shall be conducted by a NYS licensed asbestos abatement contractor employing trained and certified personnel as required by all applicable codes and regulations. After the Contract has been awarded, no subcontracting of the abatement work to another abatement contractor will be permitted.

1.5 PRE-CONSTRUCTION CONFERENCE

A. Prior to start of any preparatory work under this Contract, the Abatement Contractor shall attend a pre-construction conference attended by Owner or designated representative, Environmental Consultant for the Owner, Project Architect/Engineer and Project Monitor.

B. Agenda for this conference will include but not necessarily be limited to:

1. Abatement Contractor's scope of work, work plan, schedule and list of required submittals.

2. Abatement Contractor's safety and health plan, PPE and decontamination procedures.

3. Project Monitor’s air monitoring plan, if applicable to the project.

4. Abatement Contractor's work procedures including, job site preparation, decontamination chamber set-up, wetting agents, methods of handling removed ACM, disposal procedures; cleanup procedures and equipment; signs and labels; fire exits; and emergency procedures.

5. Abatement Contractor's plan for 24-hour job security both for prevention of theft and for barring entry of curious, unprotected personnel or the public into work areas.

6. Location of temporary utilities.

7. Handling of mechanical, electrical, HVAC systems, and other moveable objects.

C. Before any site work begins, the Contractor shall conduct a space-by-space inspection with a representative of the building owner, and prepare a written inventory of all existing damage in those spaces, which may be impacted by the contractors work. Document existing condition of the work areas, review overall work plan, water supply and temporary electric tie-in locations

1.6 DELIVERY AND STORAGE

A. Store all materials at the job site in a suitable and designated area. Store materials subject to deterioration or damage away from wet or damp surfaces and under cover.

B. Remove damaged or deteriorated materials from the job site. Materials contaminated with asbestos shall be disposed of as asbestos debris as herein specified.

1.7 TEMPORARY UTILITIES

A. Electric:

1. Provide required temporary electric service with Ground Fault Circuit Interrupters (GFCI) for all electric requirements within each asbestos abatement work area. Provide temporary wiring and receptacles in sufficient quantity to serve all negative air units, HEPA vacuums, tools and air monitoring equipment. Obtain electrical power from Owner's existing power distribution system providing: 1) Contractor provides moisture barriers around all electrical conduits and junction boxes that remain energized and pass through work areas and, 2) Contractor shall provide a back-up emergency generator for the duration of the abatement project to be used should failure of the primary power source occur.

2. Provide temporary lighting, *if required*, for all work areas. Lighting shall provide adequate intensity so the Project Monitor can perform daily monitoring procedures and abatement personnel can perform removal activities safely, efficiently and completely.

3. All temporary devices and wiring used in the work area shall be capable of decontamination procedures including HEPA vacuuming and wet-wiping.

B. Water:

1. Provide temporary source of water with separate valves for hot and cold water from Owner's existing system. *In the event of hot water shut off from Owner's system, the Abatement Contractor shall be prepared to provide hot water to meet all regulation requirements.* Hot and cold water service shall be provided to showers in the decontamination chamber.

1.8 ELECTRICAL CODES, STANDARDS, AND NOTIFICATIONS

A. Perform all electrical installation and removal work, *if required*, in accordance with applicable requirements of:

1. National Electrical Code (NEC)

2. New York State Uniform Fire Prevention and Building Code

3. NFPA 101, "Life Safety Code".

B. All electrical devices, materials, and equipment shall meet the requirements of a recognized testing agency, such as the Underwriters' Laboratories, Incorporated, and shall bear its label.

C. If requested by the Owner, where equipment other than that specified is proposed for use under this Contract, submit a list of installations within New York State where the proposed equipment has operated satisfactorily for a period of at least five years.

D. Notify and obtain permission from the Owner 48 hours in advance of interrupting any utilities.

1.9 DEFINITIONS

A. The following definitions apply throughout the Contract Documents:

1. Aggressive Air Sampling - Air sampling technique whereby air samples are collected while fans are operated in work area, and while floors, walls, and other structural surfaces are swept with constant air movement to entrain any particles that may be present. Aggressive air sampling shall be used at the completion of abatement to obtain clearance air data.

2. Airlock - a system (consisting of three curtained doorways) for permitting ingress or egress without permitting air movement between any two adjacent areas.

3. Air Monitoring - The process of measuring the fiber content of a specific volume of air in a stated period of time. Analysis of air samples shall be by Phase Contrast Microscopy (PLM) in accordance with NIOSH Method 7400, or Transmission Electron Microscopy (TEM) in accordance with EPA methodology.

4. Amended Water - Water to which a surfactant has been added at a ratio according to the manufacturer's directions.

5. Area Air Sampling - Any form of air sampling or monitoring where the sampling device is placed at a stationary location.

6. Asbestos Handler - An individual, who installs, removes, applies, encapsulates, or encloses asbestos or asbestos material or who disturbs friable asbestos.

7. Asbestos Handling Certificate - Certificate issued by the New York State Commissioner of Labor to a person who has satisfactorily completed an approved asbestos safety program.

8. Asbestos Handling License - A license issued by the New York State Commissioner of Labor pursuant to the provisions of Part 56, Title 12, NYCRR to a contractor engaged in the installation, removal, application, enclosure or encapsulation of asbestos or asbestos material or the disturbance of friable asbestos.

9. Asbestos Project - Work undertaken by a Contractor, which involves the installation, removal, encapsulation, enclosure of asbestos or asbestos material, or the disturbance of friable asbestos. At the time that such disturbance occurs, the project shall become an asbestos project and all further work on that portion of the project, which resulted in such disturbance, shall be conducted in accordance with the requirements of this specification. Where asbestos work is subcontracted to a Contractor with an asbestos handling license, only that part of work involving asbestos shall be deemed to be an asbestos project.

10. Asbestos Work Area - A work space as indicated in the contract drawings within which all exposed surfaces, except those covered with asbestos-containing materials being removed, or unless otherwise specified and fixed equipment have been sealed with intact layer(s) of polyethylene sheeting. Any work resulting in the release of asbestos fibers must be performed in the asbestos work area.

11. Authorized Visitor - A representative of the building owner, or a representative of any regulatory or other agency having jurisdiction over the project.

12. Background Monitoring - Method used to determine airborne asbestos fiber concentrations inside and outside of an abatement work area prior to starting an asbestos project.

13. Building Owner - The person or agency in which legal title to the premises is vested unless the premises are held in a land trust, in which instance Building Owner means the person to whom beneficial title is vested.

14. Equipment Room - A room between the holding room and non-work area, which is part of the equipment/waste decontamination enclosure system. The clean equipment room comprises an airlock and must be maintained in uncontaminated condition at all times.

15. Clean Room - An uncontaminated room, which is part of the worker decontamination enclosures system, with provisions for storage of workers' street clothes and protective equipment.

16. Critical Barrier - A unit of temporary construction, which provides separation of an asbestos work area and an adjacent, potentially occupied space. The critical barrier will be composed of at least two independent and intact sheets of 6-mil fire-retardant polyethylene. All seams shall be sealed airtight. Where applicable, barriers shall be framed and sheathed as described by NYS ICR-56.

17. Curtained Doorway - A device, which is constructed, of three overlapping sheets of fire retardant 6-mil polyethylene sheeting over an existing or temporarily framed doorway.

18. Differential Air Pressure System - A portable, powered HEPA-filtered system used to exhaust air from the work area to outside the building. A differential pressure must be maintained at any point in the work areas no less than -0.025 inches water gauge relative to the pressure at any point outside the work area.

19. Encapsulant - A liquid material which can be applied to asbestos-containing material and which controls the release of asbestos fibers from the material by creating a membrane over the surface (bridging encapsulant) or by penetrating into the material and binding its components together (penetrating encapsulant).

20. Encapsulation - all herein specified procedures necessary to coat asbestos-containing material or asbestos contaminated surfaces with an encapsulant to control the possible release of asbestos fibers into the ambient air.

21. Enclosure - The construction of airtight walls, ceiling and floors between the asbestos material and the facility environment, or around surfaces coated with asbestos materials, which prevents the release of asbestos materials.

22. Environmental Consultant – A technical representative of/for the Building Owner.

23. Equipment/Waste Decontamination Enclosure System - A decontamination system for materials and equipment consisting of a designated area of the work area for a washroom, and holding room separated from the work area and from each other by two airlocks.

24. Equipment Room - A room, which is part of the personal decontamination enclosure system, with, provisions for storage of contaminated clothing or equipment. The equipment room shall be HEPA vacuumed and/or wet cleaned at the end of each shift.

25. Final Clearance Level - Air samples for analysis using PCM and/or TEM collected under aggressive sampling conditions. The airborne asbestos level will be considered acceptable upon meeting the criteria specified.

26. Glove Bag Technique - A method for removing asbestos material from heating, ventilating, and air conditioning ducts, piping runs, valves, joints, elbows, and other non-planar surfaces in a non-contained work area. The glove bag assembly is a manufactured device consisting of a glove bag construction of at least 6-mil transparent plastic, two inward-projecting long sleeve gloves, which may contain an inward-projecting water-wand sleeve, internal tool pouch, and an attached, labeled receptacle or portion for asbestos waste. The glove bag is constructed and installed in such a manner that it surrounds the area to be contaminated and to contain all asbestos fibers released during the abatement process.

27. Grade D Air - Breathing air which has between 19.5% - 23% oxygen, no more than 5 mg/m^3 of condensed hydrocarbons, no more than 20 ppm of carbon monoxide, no pronounced odor, and a maximum of 1000 ppm carbon dioxide.

28. Ground Fault Circuit Interrupter - A circuit breaker that is sensitive to very low levels of current leakage from a fault in an electrical system.

29. HEPA Filter - A high efficiency particulate air (HEPA) filter, which has a tested and documented efficiency for trapping and retaining a minimum of 99.97% of a 0.3-micrometer (aerodynamic diameter) dioctylpthalate (DOP) test aerosol.

30. HEPA Vacuum Equipment - vacuuming equipment with a HEPA filtration system capable of collecting and retaining asbestos fibers.

31. Holding Room - A room between the washroom and a non-contaminated work area.

32. Large Asbestos Project - An asbestos project involving the installation, removal, disturbance, enclosure, or encapsulation of 160 square feet or more of asbestos or asbestos material or 260 linear feet or more of asbestos or asbestos material as defined by the New York State Industrial Code Rule 56.

33. Minor Asbestos Project - An asbestos project involving the installation, removal, disturbance, repair, encapsulation or enclosure of 10 square feet or less of asbestos material or 25 linear feet or less of asbestos or asbestos material.

34. Negative Pressure - An atmosphere created in a work area enclosure such that airborne fibers tend to be drawn through a filtration system rather than leak out into the surrounding areas. Air pressure inside the work area is less than that outside the work area.

35. Personal Air Monitoring - A method used to determine an individual's exposure to airborne fibers. The sample is collected outside the respirator in the person's breathing zone and analyzed in accordance with the OSHA reference method.

36. Personal Decontamination Enclosure System - A decontamination system for workers consisting of a clean room, a shower room, an equipment room, separated from each other and from the work area by three air locks.

37. Plasticize - To cover floors, walls, ceilings and other surfaces with fire retardant 6-mil polyethylene sheeting as herein specified.

38. Pre-cleaning - The process of cleaning all non-contaminated objects, ceilings, wall and floors of a proposed work area

using wet cleaning methods, HEPA vacuuming equipment, etc., before abatement work commences.

39. PCM-Clearance Level - A maximum total fiber concentration achieved under aggressive sampling conditions deemed acceptable in a work area at the completion of asbestos-related work. The PCM-clearance level criteria of less than 0.01 total fibers longer than or equal to 5 micrometers per cubic centimeter of air (f/cc) is required as determined by PCM in accordance with NIOSH Method 7400.

40. Shower Room - A room between the clean room and the equipment room in the worker decontamination enclosure system equipped with a shower with hot and cold or warm running water. The shower will be suitably arranged for complete showering during decontamination with a sufficient supply of soap at all times.

41. Small Asbestos Project - A project involving the installation, removal, disturbance, enclosure, or encapsulation of more than 10 and less than 160 square feet of asbestos or asbestos material or more than 25 and less than 260 linear feet of asbestos material.

42. Surfactant - Water used for wetting asbestos-containing materials and for wet wiping asbestos-contaminated material/debris during cleanup operations shall be amended with a commercially available wetting agent (surfactant) per the manufacturer's instructions. The surfactant used shall be non-carcinogenic and non-toxic under normal use.

43. Washroom - A room between the work area and holding area in the equipment/waste decontamination enclosure system. The washroom is separated from the work area and holding area by two air locks.

44. Wet Cleaning - The process of eliminating asbestos and particulate contamination from building surfaces and objects by using cloths, mops, or other cleaning tools, which have been dampened with amended water, and by afterwards disposing of these cleaning tools as asbestos-contaminated waste.

45. Work Area - Designated room, space, or area of the project in which asbestos abatement actions are to be undertaken or which may become contaminated as a result of such abatement actions. A contained work area is a work area, which has been sealed, plasticized, and equipped with a decontamination enclosure system. A non-contained work area is an isolated or controlled-access work area which has not been plasticized nor equipped with a decontamination enclosure system.

1.10 AIR MONITORING

A. Air monitoring, where applicable to the project, shall be completed by a NYSDOL licensed Project Monitor or Air Sampling Technician retained by the Owner. The Air Monitoring Firm shall have a minimum of 5-years experience as a N.Y. State Department of Labor licensed firm and shall not be permitted to utilize subcontractors with less than 5 years experience as a N.Y. State Department of Labor licensed firm to conduct the work or work under a subcontractor's license.

B. The air monitoring firm will collect air samples (i.e., background, work area preparation, asbestos handling, final cleaning & clearance) in accordance with Industrial Code Rule 56. Samples shall be analyzed using PCM methodology and/or TEM methodology, if required, by a New York State Department of Health Certified Laboratory.

C. When final visual inspections and/or clearance air monitoring is required, the Abatement Contractor shall notify the Air Monitoring Firm 48 hours, excluding weekends and holidays, in advance of the day and time when the Contractor will be ready for such visual inspections or air monitoring events to be performed.

D. Air monitoring results generated by the air-monitoring firm shall not be used by the Contractor to represent compliance with regulatory agency requirements for monitoring of worker's exposure to airborne asbestos, nor shall any other activity on the part of the Air Monitoring Firm represent the Contractor's compliance with applicable health and safety regulations.

1.11 ENVIRONMENTAL CONSULTANT

A. An Environmental Consultant will be employed to advise the Owner in matters pertaining to the progress and/or completion status of the abatement procedures and will act as the Building Owner's liaison in technical matters involving the asbestos-related work.

B. The Environmental Consultant is authorized by the Owner to have unlimited access to all asbestos work areas while conducting visual inspections or other requirements of his duty.

C. The Environmental Consultant may stop the Abatement Contractors work if in the course of performing their inspection duties, they observe an instance of substantial non-conformance with the contract documents and/or a situation presenting a health hazard to workers or Building Owner employees. Work shall not resume until corrective measures have been carried out.

D. Any stop work orders issued by the owner or the Environmental Consultant pursuant to the above provisions will not be grounds for claims to be made by the Contractor for damages caused by the associated delay nor will it extend the contract completion date.

E. When visual inspections are specified, the Contractor shall notify the Environmental Consultant 48 hours, excluding weekends and holidays, in advance of the day and time when the Contractor will be ready for such inspections. The Contractor's supervisor must conduct a thorough inspection of work area prior to requesting review by the Environmental Consultant.

F. The Environmental Consultant's role in advising the Building Owner does not relieve the Contractor's obligation to comply with all applicable health and safety regulations promulgated by the federal, state, and local governments.

1.12 LICENSING AND CERTIFICATION – NYS DEPARTMENT OF LABOR REQUIREMENTS

A. The Abatement Contractor must hold a current, valid asbestos-handling license issued by the New York State Commissioner of Labor.

B. A copy of the Abatement Contractor's license shall be conspicuously displayed proximate to but outside the work area during the duration of the project.

C. The Abatement Contractor shall permit only those persons who hold valid asbestos handling certificates to engage in work on this project.

PART 2 - PRODUCTS

2.1 RESPIRATORS

A. Select respirators from those approved by Mine Safety and Health Administration (MSHA) or National Institute for Occupational Safety & Health (NIOSH) as required by 29 CFR 1926.1101. Abatement contractor shall comply with section 3.2 of this specification and shall produce historical data representative of employee exposure, and shall use historical data to determine requirements for initial respiratory protection. Provide replacement HEPA cartridges to assure a change of filters at each decontamination shower procedure. Single use, disposable-type respirators shall not be used.

B. Whenever type "C" respirator protection is used, compressed air systems shall be designed to provide air volumes and pressures to accommodate respirator manufacturer's specifications. Compressors must meet the requirements of 29 CFR 1910.134(d) and must have an in-line carbon monoxide monitor equipped with an audible alarm.

C. Whenever powered purifying respirator protection is used, a sufficient supply of replacement batteries and HEPA filter cartridges shall be provided to the workers.

D. During encapsulation operations or use of organic based aerosols, if required, the Contractor shall provide workers with type GMB-H combination cartridges or equivalent respirator filters.

2.2 PROTECTIVE CLOTHING

A. The Abatement Contractor shall provide a sufficient quantity of protective clothing to all authorized persons entering regulated work areas until the work has been completed.

B. The Contractor shall provide fire retardant disposable whole body clothing, head coverings, gloves and foot coverings. Provide sufficient quantities to assure a minimum of four complete disposable outfits per day for each individual performing abatement related work.

2.3 TOOLS AND EQUIPMENT

A. Store materials subject to damage off the ground, away from wet or damp surfaces, and under cover to prevent damage or contamination. Materials not capable of being decontaminated shall be disposed of in accordance with applicable regulations.

B. Provide suitable tools for removal of asbestos-containing materials. Damaged materials shall not be used and shall be removed from the work site. Wire brushes and pressure washers shall not be used as a means of removing or cleaning asbestos-containing materials.

C. Airless sprayers capable of spraying amended water shall be provided in sufficient number to allow continuous uninterrupted work.

D. Transportation equipment, as required, shall be suitable for loading, temporary storage, and unloading of contaminated waste without exposure to persons or property, and shall be quiet in motion if used within the building.

E. Power tools used to drill, cut, saw or otherwise disturb asbestos material shall be equipped with HEPA filtered local exhaust ventilation.

F. The Contractor shall make available to authorized visitors, ladders and/or scaffolds of sufficient dimension and quantity so that all work areas can be easily and safely reached. Scaffolds and ladders shall comply with all applicable codes.

2.4 PERSONAL DECONTAMINATION SYSTEM ENCLOSURE

A. Personal decontamination enclosures shall be constructed and functional prior to commencing regulated abatement work area preparation activities. After installation of the personal decontamination system enclosure, all access to the regulated abatement work area shall be via the installed personal decontamination system enclosure.

B. Attached - Large Project

1. General: A personal decontamination system enclosure shall be provided outside the regulated abatement work area and attached to all locations where personnel shall enter or exit the regulated abatement work area. *One personal decontamination enclosure system for each regulated abatement work area shall be required*. The personal decontamination system enclosure shall be sized to accommodate the number of workers and equipment required for the intended purpose. At least one layer of six-mil fire-retardant plastic sheeting shall be installed on the ceiling, and walls of the enclosure system. At least two layers of six-mil fire-retardant reinforced plastic sheeting shall be used for flooring protection of this area. This system must be kept clean, sanitary and climate controlled at all times. This system shall remain on-site, operational and be used until completion of the asbestos project.

2. Rooms and Configuration: The personal decontamination system enclosure shall consist of a clean room, a shower room and an equipment room connected in series but separated from each other by airlocks. There shall be a curtained doorway separation between the equipment room and the regulated abatement work area, and there shall be a lockable door to the outside.

3. Curtained Doorway: An assembly which consists of at least three overlapping sheets of six-mil fire retardant plastic over an existing or temporarily framed doorway. One sheet shall be secured at the top left side, the second sheet at the top right side, and the third sheet at the top left side. All sheets shall have weights attached to the bottom.

4. Framing: Enclosures systems accessible to the public shall be fully framed; hard-wall sheathed, such as plywood or oriented strand board (OSB) sheathing material of at least 3/8-inch thickness.

5. Plastic Sheeting: Enclosure systems constructed at the work site shall use at least one layer of six-mil fire-retardant plastic sheeting on walls and ceiling. At least two layers of six-mil fire-retardant reinforced plastic sheeting shall be used for floor protection.

6. Prefabricated or Trailer Units: A completely watertight prefabricated unit does not require plasticizing. All prefabricated or trailer decontamination units shall be kept in good condition, and shall be decontaminated after final cleaning and immediately prior to clearance air sampling. Upon receiving satisfactory clearance air results of the regulated abatement work area, the prefabricated units shall be sealed then separated from the regulated abatement work area.

7. Clean Room: The clean room shall be sized to accommodate a full work shift of asbestos abatement personnel, as well as the project monitor. The clean room shall be a minimum of six feet in height. A minimum of thirty-two square feet of floor space shall be provided for every six full shift abatement workers. If the largest work shift consists of three or less full shift abatement workers, the minimum clean room size requirement is reduced to twenty-four (24) square feet of floor space. Benches, lockers and hooks shall be provided for street clothes. Shelves for storing respirators shall be provided. *The clean room shall not be used for storage of tools, equipment or used for office space.* A lockable door

shall be provided to permit access to the clean room from outside the regulated abatement work area or enclosure and shall be used to secure the regulated abatement work area and decontamination enclosure during non-work hours.

8. Shower Room: The shower room shall contain one shower per every six full shift abatement worker, calculated on the basis of the largest work shift. Multiple showers shall be simultaneously accessible (installed in parallel) to certified personnel. Each showerhead shall be supplied with hot and cold water adjustable at the tap. The shower enclosure shall be constructed to ensure against leakage of any kind. Uncontaminated soap, shampoo and towels shall be available at all times. Shower water shall be drained, collected and filtered through a system with at least 5.0-micron particle size collection capability. Filtered wastewater shall be discharged in accordance with applicable codes. Contaminated filters shall be disposed of as asbestos contaminated waste.

9. Equipment Room: The equipment room shall be used for the storage of decontaminated equipment and tools. A one day supply of replacement filters for HEPA-vacuums and negative pressure ventilation equipment in sealed containers, and other materials that may be required during the abatement project may also be stored here. A container lined with a labeled, at least six-mil plastic bag for collection of clothing shall be located in this room. Contaminated footwear and work clothes shall be stored in this area.

10. Airlocks: Airlock construction shall consist of two curtained doorways with three alternating six-mil fire retardant polyethylene curtains per doorway, separated by a distance of at least three feet, such that one passes through one doorway into the airlock, allowing the doorway sheeting to overlap and close off the opening before proceeding through the next doorway.

C. Attached - Small Project

1. General: A personal decontamination system enclosure for a Small asbestos project shall consist of, at a minimum, an equipment room, a shower room and a clean room separated from each other and from the regulated abatement work area and other areas by curtained doorways as defined in Section 56-2.1. All other provisions for personal decontamination system for a Large asbestos project shall apply. Equipment storage, personal gross decontamination and removal of clothing shall occur in the equipment room just prior to entering the shower.

D. Remote

1. General: If a personal decontamination system cannot be attached to the regulated abatement work area, due to available space restrictions or other building and fire code restrictions, a remote personal decontamination system enclosure may be used for limited Special Projects as per subpart 56-11. If during abatement activities, non-friable ACM becomes friable during the removal process, and it is logistically possible to attach the decontamination system enclosure, abatement work must stop immediately while the remote personal decontamination system is relocated to be attached and contiguous to the regulated abatement work area.

2. Protective Clothing: Workers shall don two (2) sets of disposable protective clothing and a supply of protective clothing shall be kept in the airlocks attached to the regulated abatement work area.

3. Location: The remote personal decontamination system shall be constructed as close to the regulated abatement work area as physically possible. If the remote personal decontamination system must be located at the exterior of the building due to space or code restrictions, it shall be constructed within fifty feet of the building exit used for access by the asbestos abatement personnel. The decontamination unit shall be cordoned off at a distance of twenty-five feet to separate it from public areas/access.

4. Airlocks: At a minimum, two extra airlocks as defined in Section 56-2.1 shall be constructed. One shall be constructed at the entrance to the equipment room or equipment/washroom. The other extra airlock shall be constructed at the entrance to the containment or regulated abatement work area(s). These airlocks shall have lockable doorways at the entrance to the airlock from uncontaminated areas. These airlocks shall be cordoned off at a distance of twenty-five feet and appropriately signed in accordance with Section 56-7.4(c). *Airlocks shall not be used as a waste decontamination area and shall be kept clean and free of asbestos containing material.*

5. Designated Pathway: The walkway from the regulated abatement work area to the personal decontamination system or next regulated abatement work area shall be cordoned off and signage installed as per Section 56-7.4(c).

6. Travel Through Uncontaminated Areas: If at any time a worker must travel through an uncontaminated area to access the personal decontamination area, the worker shall HEPA-vacuum and/or wet wipe his/her outer protective clothing while in the regulated abatement work area, then proceed into the airlock, which serves as a changing area, where

he/she shall remove the outer clothing and don a clean set of protective clothing. The worker may then proceed to the personal decontamination system enclosure only along a designated pathway as described above.

7. Removal: The remote personal decontamination unit shall be removed only after satisfactory clearance air sampling results have been achieved.

2.5 WASTE DECONTAMINATION SYSTEM ENCLOSURE

A. General: A waste decontamination system enclosure shall be provided outside the regulated abatement work area and shall be attached to the regulated abatement work area. *One waste decontamination enclosure for each regulated abatement work area shall be required.* The waste decontamination system enclosure shall be sized to accommodate the number of workers and equipment for the intended purpose. Such system may consist of existing attached rooms outside of the regulated abatement work area, if the layout is appropriate, that can be plasticized and are accessible from the regulated abatement work area. This system must be kept clean, sanitary and climate controlled at all times.

B. Waste Decontamination System Enclosure - Large Asbestos Project

1. Rooms and Configuration: A waste decontamination system enclosure shall consist of a washroom and a holding area connected in series but separated from each other by an airlock. There shall be a lockable door to the outside, and there shall be a curtained doorway between the washroom and the regulated abatement work area.

2. Curtained Doorway: One sheet shall be secured at the top left side, the second sheet at the top right side, and the third sheet at the top left side. All sheets shall have weights attached to the bottom.

3. Washroom: A room/chamber between the regulated abatement work area and the holding area in the waste decontamination system enclosure, where equipment and waste containers are wet cleaned or HEPA vacuumed.

4. Equipment/Washroom Alternative: Where there is only one exit from the regulated abatement work area, the holding area of the waste decontamination system enclosure may branch off from the equipment room of the personal decontamination system enclosure. The equipment room will also be used as a waste washroom.

5. Plastic Sheeting: Waste decontamination system enclosures constructed at the work site shall use at least one layer of six-mil fire-retardant plastic sheeting on walls and ceiling. At least two layers of six-mil fire-retardant reinforced plastic sheeting shall be used for flooring protection of these areas.

6. Enclosure Security: The waste decontamination system enclosure and regulated abatement work area airlock(s) shall be constructed with lockable doors to prevent unauthorized entry. Enclosures systems located within twenty-five feet of an area of public access shall be fully framed and hard-wall sheathed for safety.

7. Drains: The waste washroom shall be equipped with a wash bin of sufficient size to perform waste container washing operations and shall have a submersible pump installed to collect waste water and deliver it to the shower wastewater filtration system where it shall be filtered in accordance with 56-7 (b)(9).

C. Waste Decontamination System Enclosure - Small Asbestos Project

1. For Small asbestos projects with only one exit from the regulated abatement work area, the shower room may be used as a waste washroom. The clean room shall not be used for waste storage, but shall be used for waste transfer to carts, which shall be immediately removed from the enclosure. Waste shall be transferred only during times when the showers are not in use.

D. Waste Decontamination System Enclosure – With Remote Personal: When a remote personal decontamination system enclosure is allowed and utilized for a regulated abatement work area, the following requirements shall apply:

1. Minor Size Asbestos Project: No specific waste decontamination system enclosure is required for minor size regulated abatement work areas. The waste generated shall be immediately bagged or containerized within the regulated abatement work area.

2. Small & Large Size Asbestos Project
   (i) Washroom: An additional chamber shall be constructed within the regulated abatement work area, attached to the existing airlock used to access the work area. The washroom/airlock combination shall be utilized as the contiguous waste decontamination enclosure for waste bagging and transfer activities.

(ii) Removal: The washroom chamber shall be removed only after satisfactory clearance air sampling results have been achieved.

2.6 SIGNAGE AND LABELS

A. Provide (bilingual) caution signs and barrier tapes at all approaches to regulated work areas. Locate signs at such distance that personnel may read the sign and take the necessary protective steps required before entering the area. Provide caution signs in vertical format conforming to 29 CFR 1910.145(d) (4), and 1926.1101, minimum 20" x 14" displaying the following:

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING ARE
REQUIRED IN THIS AREA

B. Provide asbestos caution labels affixed to all disposable 6-mil plastic bags, drums or containers for waste containerization, asbestos scrap, waste, debris, and other products/materials contaminated with asbestos displaying the following:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

C. The Abatement Contractor shall provide a daily entry/exit log, which shall be posted at the entrance to each regulated work area. All persons entering a regulated work area shall sign the entry/exit log upon every entry/exit. All persons, before entering a regulated work area, shall read and be familiar with all posted regulations and personal protection requirements. A copy of a valid asbestos-handling license of the Abatement Contractor and all abatement personnel who are performing the work shall be conspicuously displayed at the work site.

2.7 TEMPORARY ENCLOSURES (CRITICAL BARRIERS)

A. The framework and associated plywood sheeting (or similar) of the temporary enclosures shall be provided by the Abatement Contractor. The Contractor shall use these enclosures to completely isolate the asbestos work area from other non-work/unsealed parts of the building so as to prevent asbestos-containing dust or debris from passing beyond the isolated area.

B. Enclosures and/or critical barriers shall consist of double layer minimum 6-mil fire retardant polyethylene sheeting for wall, floor and ceiling surfaces and reinforced 6-mil fire retardant polyethylene sheeting for application to temporary framing. Vertical sheeting shall be secured to walls and/or temporary framing with spray adhesive then sealed with duct tape. Provide sheeting of up to 20' widths for floor and wall surfaces to minimize the number of joints. Smoke test all sealed openings for airflow.

C. Critical barriers shall be constructed by the Abatement Contractor at the interior side of all work areas and/or other required work areas such as but not limited to, classrooms, hallways, entrance/exit ways, and other rooms which adjoin specified work areas, and openings at windows, vents, ducts, near specified work areas in accordance with Industrial Code Rule 56.

D. Access to enclosure shall be through the decontamination chamber only.

E. Emergency fire exits shall be framed out and taped, and posted as emergency exits only. Use of emergency exits for other than fire emergencies shall constitute non-compliance with the Contract Documents resulting in a stop work order by the Project Monitor.

2.8 NEGATIVE AIR PRESSURE FILTRATION SYSTEM

A. Negative Air Pressure Equipment: All OSHA Class I, Class III, and interior Class II asbestos abatement projects shall employ negative air pressure equipment ventilation.

1. Operation: The negative air pressure equipment shall operate continuously from startup of negative pressure equipment until satisfactory clearance air sampling results are obtained.

2. Timing of Installation: The negative air ventilation units shall be installed and made operational after the critical barriers and isolation barriers are installed.

3. Negative Air Pressure: A negative air pressure, relative to areas outside of the enclosure, shall be maintained at all times in the regulated abatement work area to ensure that contaminated air does not escape back to an uncontaminated area.

4. Manometer: A manometer shall be used to document the pressure differential for all OSHA Class I Large and Small size asbestos projects. A minimum of –0.02 column inches of water pressure differential, relative to pressure outside the regulated work area, shall be maintained within the regulated work area, as evidenced by manometric measurements. The manometer shall be installed and made operational once the negative air has been established in the regulated abatement work area. *Once installed, at least twice per workshift, the Abatement Contractor shall document the manometer reading within the daily project log.*

5. Ventilation Units: If more than one primary HEPA-filtered ventilation unit is installed, the units shall be turned on one at a time and the integrity of temporary hardwall isolation barriers checked for secure attachment. A minimum of one additional unit having a capacity of at least equal to that of the primary unit shall be installed, as a backup unit to be used upon primary unit failure, or if necessary during primary unit filter changes. *Ventilation exhaust ducting shall not exceed twenty-five (25) feet in length.*

6. Power Failure: In the event of electric power supply failure, abatement shall stop immediately and not resume until power is restored and exhaust units are operational. In the event of extended power failure (longer than one hour), the decontamination system enclosure facilities shall be sealed airtight.

7. Air Changes: Negative air pressure ventilation equipment shall be installed and operated continuously to provide at least four air changes in the regulated abatement work area every hour including during clearance air sampling.

8. Openings in Enclosure: Openings made in the enclosure system to accommodate these units shall be made airtight with duct tape or caulking or both.

10. Installation and Care: Proper installation procedures, including use of appropriate filters and manufacturer's recommended operating procedures shall be followed as stated in Industrial Code Rule 56-7(10)(i-viii).

11. Exhaust Location: Each negative pressure ventilation unit exhaust duct shall not terminate less than fifteen feet from a receptor or adversely affect the air intake of any building or structure. If the exhaust duct termination location for this Section cannot be met due to allowable space restrictions or the regulated abatement work area being located above the ground floor, the exhaust shall terminate at the exterior of the building, and all receptors less then fifteen feet from the exterior exhaust duct termination location shall be plasticized with two layers of at least six-mil polyethylene. Exhaust tubes may be grouped together in banks of no more than five tubes, with each tube exhausting separately and the bank of tubes terminating together at the same controlled area.

2.9 ABATEMENT CONTRACTOR DAILY PROJECT LOG

A. The Abatement Contractor shall maintain a daily project log of all pertinent events that occur throughout the asbestos project. This project log shall be updated daily by the on-site supervisor, and shall be kept on-site for the duration of the asbestos project. This log shall be made available upon verbal request of the Commissioner or his or her duly authorized representative.

B. The following list summarizes various items that require entries into the daily project log by the asbestos abatement contractor supervisor:

1. High air result(s) shall be noted with the time of work cessation, results of barrier and negative air system inspection, summary of any necessary repairs and required cleaning.

2. Manometer Readings which are to be documented twice per work shift.

3. Daily inspection results of the negative air system (*even days without work shifts*) and any necessary repairs to be documented.

4. Daily inspection results of HVAC System Positive Pressurization (*even days without work shifts*) and any necessary repairs to be documented.

5. Daily inspection results of barrier inspections (*even days without work shifts*) and any necessary repairs to be documented. Inspections shall be conducted twice per work shift on days with scheduled work.

6. Daily testing results of barriers and enclosures and any necessary repairs shall be documented.

7. Documented daily cleaning of enclosures at the end of each work shift.

8. Results of each visual inspection and time of each intermediate completion shall be documented by the supervisor in the daily project log.

9. Visual inspections conducted by Project Monitor prior to Clearance Air Sampling.

10. Visual inspection conducted by Project Monitor for regulated abatement work areas exempt from Clearance Air Sampling.

11. Final Inspection, air sampling or visual, conducted by Project Monitor.

2.10 SCAFFOLDING

A. Provide scaffolding, if required, and/or staging as necessary to accomplish the work. The type, erection and use of scaffolding shall comply with all applicable OSHA provisions.

B. Scaffolding legs shall be provided with lockable rubber casters or equal means to protect plastic floor covering from damage. Scaffold joints and ends shall be sealed to prevent incursion of asbestos debris.

2.11 CHEMICAL REMOVAL AGENT (WETTING AGENT)

A. Sufficiently wet all ACMs prior to removal with a non-toxic, non-combustible chemical agent mixed and applied in accordance with manufacturer's printed instructions. Chlorinated removal agents shall not be used at this Project.

2.12 ENCAPSULANT

A. After first cleaning and prior to first sheeting removal, and after the work area has been rendered free of visible residues, a thin coat of an encapsulating agent may be applied to surfaces in the work area that were not the subject of removal.

B. Surfaces indicated on the Contract Drawings to be "encapsulated", *if any*, shall be sealed with a bridging encapsulant. The encapsulant shall be applied at an application rate recommended by the product manufacturer and in accordance with Industrial Code Rule 56. The bridging type encapsulant with the following characteristics:

1. Shall not be solvent-based or utilize hydrocarbons in the liquid in which the solid parts of the encapsulant are suspended and be compatible with the anticipated replacement product.
2. Shall be non-flammable, compatible with concrete, metals, wood, cable jacketing, etc. and shall prevent fire, smoke, water and toxic fumes from penetrating through sealants.

C. Encapsulant shall be applied only after all specified asbestos materials have been removed and work area cleaned of all loose debris.

D. Where encapsulation is used to supplement removal of ACM pipe/pipefitting, a non-hardening lagging sealer shall be used for sealing all raw exposed edges and surfaces.

2.13 DISPOSAL BAGS, DRUMS, AND PLASTIC SHEETING

A. Provide, at a minimum, 6-mil polyethylene bags pre-printed with caution labels for asbestos debris. Provide, at minimum, 6-mil polyethylene plastic sheeting, affix asbestos caution labels accordingly. Provide clean 30 or 55-gallon fiber, plastic or metal drums capable of being sealed water tight for asbestos waste and debris. Affix asbestos caution labels accordingly.

2.14 HEPA VACUUM EQUIPMENT

A. Vacuuming performed under this Contract shall be performed with HEPA filter equipped industrial vacuums conforming to ANSI Z9.2. Wet-Vac units, when utilized, shall be exhausted to the manifold of the Negative Air Filtration Unit

B. Provide tools and specialized equipment including scraping nozzles with integral vacuum hoods connected to a HEPA vacuum with flexible hose. Power tools used to drill, cut, or otherwise disturb ACM shall be equipped with HEPA filtered local exhaust ventilation.

PART 3 - GENERAL

3.1 GENERAL REQUIREMENTS

A. Perform asbestos related work in accordance with 29 CFR 1926.1101, 40 CFR 61 and, 12 NYCRR 56 and as specified herein. Where more stringent requirements are specified, adhere to the more stringent requirements.

B. During the progress of the work, other contractors may be engaged in performing work. The Abatement Contractor shall coordinate his work with the work of other contractors in such a manner as the Owner or his Construction Manager may direct.

C. The Abatement Contractor shall complete all asbestos work within the accepted schedule, and shall provide staffing as necessary to complete the scope of work awarded by the Owner. This shall include working multiple shifts Monday through Friday, Saturday, and Sunday, if necessary. The Abatement Contractor's bid shall be inclusive of these costs.

D. In the event an area beyond the asbestos work area becomes contaminated with asbestos-containing dust or debris as a consequence of the work, immediately institute emergency procedures. Contaminated non-work areas shall be isolated and decontaminated in accordance with procedures established for asbestos removal. *All costs incurred in decontaminating such non-work areas and the contents thereof shall be the responsibility of the Abatement Contractor, at no additional cost to the Building Owner.*

E. In the event of electric power failure while abatement is in process, abatement activities shall stop immediately and shall not resume until power is restored and exhaust units are fully operational. On extended power failure, longer than one hour, the decontamination facilities, after the evacuation of all abatement personal from the work area, shall be sealed airtight.

F. Prior to start of abatement work, shut down and lock out the building's heating, ventilating and air conditioning system, *if applicable to the project*, to the regulated asbestos work areas.

G. Water services will be made available by the building owner. The Abatement Contractor shall secure and maintain all hoses and connections in a leak-free state at all times.

H. Perform asbestos removal work using wet removal procedures. Avoid excessive water use as to not cause water damage (saturation of) interior building components (i.e., plaster or gypsum wallboard, ceiling system, flooring, electrical circuitry, etc.). Mix and apply surfactant and chemical agents in accordance with manufacturer's instructions. *Dry removal of asbestos-containing materials is not permitted.*

3.2 EXPOSURE ASSESSMENT MONITORING

A. The Abatement Contractor shall perform exposure assessment air monitoring as required by OSHA 29 CFR Part 1926.1101 to determine the airborne concentrations of asbestos to which workers may be exposed. Exposure shall be made from air samples that are representative of an 8-hour TWA exposure and a 30-minute Excursion Limit (EL) exposure to workers.

B. Representative TWA worker exposures shall be determined on the basis of one or more samples representing full-shift exposure for workers in each regulated work area. Representative short-term worker exposures shall be determined on the basis of one or more samples representing 30-minute exposures associated with operations that are most likely to produce exposures above the EL for workers in each regulated work area.

C. For any one specific operation, which will be performed by certified workers, the Abatement Contractor may demonstrate that worker exposures will be below the PELs by data, which conform to the following criteria:

1. Objective data demonstrating that the material containing asbestos or the activity involving such product or material cannot release airborne fibers in concentrations exceeding the TWA and EL under those work conditions; or

2. Where the Contractor has monitored prior asbestos jobs for the PELs within 12 months of the current job; the data were obtained during work operations conducted under workplace conditions "closely resembling" the processes, type of material, control methods, work practices, and the data show that under the conditions prevailing and which will prevail in the current workplace there is a high degree of certainty that worker exposures will not exceed the TWA and EL; or

3. The results of initial monitoring of the current job made from breathing zone air samples that are representative of the TWA and EL exposures of each worker covering operations, which are likely during the performance of the entire asbestos job

to result in exposures over the PELs.

D. The Abatement Contractor shall conduct daily air monitoring that is representative of the exposure of each worker who is assigned to work within a regulated work area, unless the Abatement Contractor has made a negative exposure assessment for the entire operation.

E. The Contractor shall institute the exposure monitoring whenever there is a significant change in process, control equipment, personnel, or work practices that may result in new or additional exposures above the PELs or when there is any reason to suspect that a change may result in new or additional exposures above the PELs.

3.3 PRE-ABATEMENT REQUIREMENTS

A. The Abatement Contractor shall take all necessary measures to protect workers, subcontractors, consultants, authorized visitors, and building occupants from exposure to asbestos and shall limit use of the site to only those areas where the asbestos abatement work is required.

B. Decontamination Enclosure Systems shall be constructed prior to removal preparation activities. Personal Decontamination Enclosure Systems shall be provided outside the work area and attached to locations where persons will enter/exit the regulated work area(s).

C. Post warning signs at all appropriate work area barriers in accordance with 29 CFR 1910.145(d) (4), and 29 CFR 1926.1101 and Industrial Code Rule 56.

D. The Contractor shall coordinate with the Owner or Owner's representative to lock out electric power to the work area, and then connect required temporary electrical service. Provide grounded temporary electrical service of sufficient size, capacity, and power to accommodate work, and provide overload-protected disconnect switches for each temporary circuit.

E. The Contractor shall coordinate with the Owner and the Owner's representatives to disable ventilation systems bringing air into or out of a work area by disconnecting wires, removing circuit breakers, and installing lockable switches that will prevent accidental or premature restarting of equipment.

F. Provide lighting in the Decontamination Enclosure System as required supplying a 50-foot candle minimum light level. Provide a minimum of one, 200-watt incandescent lamp per 1,000 SF of floor area to provide uniform lighting throughout each work area.

G. When applicable, maintain a minimum temperature of 70 degrees Fahrenheit throughout the work area and Decontamination Enclosure Systems.

3.4 WORK AREA PREPARATION

A. Regulated Work Area: The asbestos abatement work shall be conducted within regulated work areas which shall be demarcated in a manner that minimizes the number of persons within the area and protects persons outside the area from exposure to asbestos. Access to regulated work areas shall be limited to certified persons and authorized visitors.

B. Critical Barriers: Critical barriers shall be constructed at the interior side of the work areas such as but not limited to, offices, hallways, entrance/exit ways, and other rooms which adjoin specified work areas as indicated on the Contract Drawings, and at all openings at windows, doors, vents, ducts, louvers and grilles near specified work areas.

C. Isolation Barriers: Isolation barriers that seal off openings in the work area including, but not limited to, windows, corridors, doorways, skylights, ducts, grilles, diffusers and any other penetrations of the work area, shall be constructed using two layers of 6-mil fire-retardant plastic sheeting sealed with duct tape. All seams in system components that pass through the work area shall be sealed. Doorways and corridors, which will not be used for passage during the abatement work, shall be sealed. Construction of isolation barriers to separate the work area from the remainder of the site shall be accomplished as follows:

1. Walls shall be constructed of wood or metal framing to support barriers in all openings larger than 32 square feet.

2. Sheathing material of at least 3/8-inch thickness shall be applied to the work side of the barrier.

3. Edges of the partition shall be caulked at the floor, ceiling, walls, and fixtures to form an airtight seal.

4. The work side of the partition shall be covered with two layers of 6-mil fire-retardant plastic sheeting with staggered joints and sealed.

5. All floor, wall and ceiling surfaces shall be covered with two layers of 6-mil fire-retardant plastic sheeting. The floor shall be plasticized first and the plastic sheeting shall extend up the walls at least 12 inches on all sides. The walls shall then be plasticized by applying plastic sheeting from ceiling to floor, and overlapping the floor sheeting by at least 12 inches. This process shall be repeated for the second layer of plastic sheeting for the floor and walls. All seams within a layer shall be separated by a distance of at least six feet and sealed airtight, and all seams between layers shall be staggered.

D. After completion of the decontamination enclosure, critical barriers and polyethylene sheeting applications, a minimum of 12 hours settling period is required before abatement work will be allowed to commence. Damage and defects in the barriers and/or enclosure system shall be repaired immediately upon discovery and prior to resumption of abatement activities.

E. Enclosure Inspections: *Daily inspections and smoke testing of all barriers shall be performed by the Abatement Contractor and shall be recorded in the daily project log.* These daily inspections shall occur prior to the start of a work shift and upon the completion of the same work shift. Inspections and observations shall be documented in a daily project log. If, at any time during abatement activities, visible emissions are observed outside the work area or if damage occurs to the barriers, work shall be stopped, repairs made, and visible residue immediately cleaned using HEPA vacuuming and/or wet cleaning methods prior to the resumption of abatement activities.

F. Personal/Waste Decontamination Enclosure System: The Contractor shall place all tools, equipment, and other materials in the work area, then construct or provide for a Personal/Waste Decontamination Enclosure System which complies with Industrial Code Rule 56.

1. Construct a Clean Room sized to accommodate all personnel/authorized persons. Benches, lockers, and hooks shall be provided for street clothes, and shelves shall be provided for storing respirators. The Clean Room shall not be used for the storage of tools, equipment, or materials, and shall not be used for office space. The Clean Room shall be locked during non-work hours.

2. Construct a Shower Room containing one showerhead per every six workers, supplied with hot and cold water adjustable at the tap. The Shower Room shall be separated from the Clean Room and the Equipment/Waste Wash Room by airlocks constructed of 6-mil, fire-retardant plastic sheeting. Soap, shampoo, and towels shall be available at all times. All used 5.0 micron filters used to filter wastewater from the shower units shall be treated as asbestos contaminated waste and disposed of as asbestos waste. Disposable towels shall be disposed of as asbestos waste. The Contractor shall provide temporary water heaters that are sufficient to provide hot water service to the decontamination chambers upon demand.

3. Construct an Equipment/Waste Wash Room for the storage of equipment and tools after decontamination. The Equipment/Waste Wash Room shall be separated from the Work Area and the Holding Area by airlocks constructed of 6-mil fire-retardant plastic sheeting. A walk-off pan filled with water shall be located outside the Equipment/Waste Wash Room for personnel to clean foot coverings. A drum lined with a 6-mil plastic bag shall be located in the Equipment/Waste Wash Room to contain clothing.

4. Construct a Holding Area as a drop location for bagged asbestos waste passed from the Equipment/Waste Wash Room. The Holding Area shall be located so that bagged asbestos waste can be passed from the Equipment/Waste Wash Room into the Holding Area. The Holding Area shall be separated from the Equipment/Waste Wash Room by an airlock constructed of 6-mil, fire-retardant plastic sheeting. A lockable door shall be installed to permit removal of containerized asbestos waste from the Holding Area to a storage facility for transport to a disposal site. The Holding Area shall be locked during non-work hours.

G. Fire alarm equipment, including smoke detectors, is to remain and shall be protected and decontaminated. Coordinate system shut down, if required, with Owner at least 24-hours in advance prior to system shut down.

H. Pre-clean fixed objects within the work area using HEPA filtered equipment and/or wet wiping methods as appropriate. Enclose with two layers of 6-mil fire retardant polyethylene sheeting sealed with duct tape and/or spray adhesive in accordance with Industrial Code Rule 56.

I. In coordination with the Building Owner, shut down and isolate HVAC systems, if applicable, to prevent contamination and fiber dispersal to other areas of the building. Openings to ducts, fans, louvers, windows, and plenums shall be sealed with two layers of fire retardant sheeting prior to start of removal. The Abatement Contractor shall repair any damage to ductwork, grilles, dampers, windows, louvers or HVAC equipment scheduled to remain at the completion of the abatement work, at no cost to the Owner.

J. All electrical conduit joints, boxes, devices and cable systems within the work area, shall be sealed with tape and polyethylene

sheeting sufficient to prevent water penetration during asbestos abatement operations. All loose cables and wiring present in the work area shall be supported so that they do not become disconnected or otherwise damaged during removal operations. Any damage to this wiring will become the responsibility of the Abatement Contractor to repair at his expense.

3.5 WORK AREA ENTRY/EXIT

A. The Abatement Contractor shall restrict all unauthorized persons from entering the regulated work areas and avoid asbestos-containing dust or debris from passing beyond the critical barriers of the regulated work areas. Should areas beyond a regulated work area become contaminated with asbestos or debris as a result of the work, the Abatement Contractor shall clean those areas in accordance with the applicable regulations. Such cleaning and/or decontamination of these non-work areas by the Abatement Contractor shall be performed at no additional cost to the Owner.

B. Authorized persons shall enter/exit regulated work areas through a Decontamination Enclosure System. Each time a regulated work area is entered, street clothes shall be removed in the Clean Room and disposable clothes and clean respirators shall be worn. Respirators shall be inspected prior to each use and fit-checked for proper seal. Personnel shall then proceed through the Shower Room to the Equipment/Waste Wash Room, and into the work area.

3.6 ASBESTOS REMOVAL

A. The abatement work areas are located in areas as indicated on the Asbestos Removal Plans. The Abatement Contractor shall refer to, at a minimum, the Architect's Renovation Drawings as well as the Asbestos Removal Plan for a detailed representation of the general layout of the work areas and the extent of asbestos removal and disposal specified at each work area.

B. The Building Owner, Owner's representative or other authorized personnel shall be allowed unlimited access to all specified work areas located throughout the site building.

C. The work consists of the removal and disposal of ACM and associated debris. Dispose of all removed material and debris as asbestos-contaminated.

D. The Abatement Contractor shall provide appropriate means (i.e., scaffolding, ladders, etc.) to access the work areas. The Abatement Contractor shall decontaminate equipment prior to moving it from one work area to another and at the completion of the Project.

E. In lieu of full compliance with Industrial Code Rule 56 the Abatement Contractor may obtain a site-specific variance, *prepared by a NYSDOL certified Project Designer*, to conduct the removal work using alternate methods and procedures. No dry removal or disturbance of asbestos materials shall be permitted.

F. Asbestos contaminated debris shall be cleaned using wet cleaning methods and/or HEPA vacuuming equipment. *Asbestos contaminated debris and water shall be placed in appropriate bags or containers, sealed, and removed from the work area daily or after each work shift.* Decontamination enclosure systems, clean room, shower, and equipment room shall be cleaned daily. The clean room shall be kept clean, dry and free of any waste.

3.7 EQUIPMENT & WASTE MATERIAL DECONTAMINATION

A. The Contractor shall remove equipment and asbestos-contaminated waste material from the regulated work area(s) through the Equipment/Waste Room according to the following:

1. At the wash down station, thoroughly wet-clean contaminated equipment and waste disposal bags and pass into the Equipment/Waste Wash Room.

2. When passing equipment or containers into the Equipment/Waste Wash Room, close all doorways of the Decontamination Enclosure System.

3. Once inside the Equipment/Waste Wash Room wet-clean bags, containers, and equipment.

4. When cleaning is complete, pass items into the Holding Area and close all doorways, except the doorway between the Equipment/Waste Wash Room and the Holding Area.

5. Workers from the exterior shall enter the Holding Area and remove decontaminated equipment and waste. The Contractor

shall require these workers to wear protective clothing and appropriate respiratory protection.

6. Workers shall not use the Equipment/Waste Wash Room system as a means to leave or enter the washroom or the work area.

B. Clean debris from the inside of the Decontamination Enclosure System on a daily basis. All surfaces shall be wet-wiped and/or HEPA vacuumed after each shift change. The Abatement Contractor shall clean debris from shower pans on a daily basis.

C. Remove asbestos waste from the work area into the Decontamination Enclosure System at least at the end of each work shift, then directly into the waste storage container. Containerized asbestos waste shall not be stored outside of the work area or outside of the waste storage container.

D. If required, provide a dust tight, enclosed, inclined chute for dropping asbestos material a distance greater than 10 feet. Drop asbestos-containing materials directly into a secured, labeled, container.

3.8 PERSONAL DECONTAMINATION

A. The Contractor shall require workers to follow a specified decontamination procedure, as a minimum requirement, when exiting a regulated work area:

1. Remove gross contamination while still in the work area. Gross removal shall be conducted by wet cleaning and/or HEPA vacuuming.

2. Remove disposable coveralls, head covers, and foot covers/boots in the Equipment/Waste Wash Room and deposit into a labeled container. Reusable contaminated clothing, footwear, headgear and gloves shall remain on in the Equipment Room.

3. While still wearing the respirator enter the shower room and clean the outside of the respirator and the exposed face area under running water prior to removal of the respirator, and then shower completely with soap and water to remove residual asbestos contamination.

4. Respirator filter cartridges shall be removed, wetted and disposed of in a container provided for the purpose.

5. Rinse the Shower Room walls and floor prior to exiting. After showering proceed to the Clean Room and don street clothes.

3.9 WASTE STORAGE, TRANSPORT & DISPOSAL

A. Provide a rigid, enclosed, and lockable waste storage container (i.e., dumpster, trailer, etc.) at the site to contain removed asbestos-containing material/debris which has been double-bagged or double-wrapped. The interior floor and walls of the waste storage container shall be lined with two layers of at least 6-mil plastic sheeting and shall be properly labeled on the exterior sides. The container shall be locked at the end of each workday and during non-work shifts.

B. Do not store containerized waste outside of a regulated work area or outside of the waste storage container. Load all containerized asbestos waste onto trucks, dumpsters, or other appropriate containers for storage prior to transport. The containerized asbestos waste shall be placed in an enclosed, locked truck or dumpster for storage. The waste storage/transport unit shall be locked when not in use to prevent unauthorized access to the waste material.

C. Double-bagged and/or double-wrapped asbestos waste may be transported on open trucks if loaded into rigid, steel drums that are properly closed and sealed. The Abatement Contractor shall label all waste disposal drums with the same warning labels as on the waste disposal bags. Drums that have been contaminated shall be disposed of as asbestos-containing waste.

D. The Contractor shall establish a manifest system that accounts for all ACM waste. The manifest system shall be described in writing and will be subject to the approval of the Owner. The Contractor shall retain receipts from the landfill where the asbestos waste is disposed. Separate waste disposal receipts shall be retained for each load of asbestos waste removed from the work site. The Contractor shall demonstrate custody over all asbestos waste from the time it is removed from the work area until it is deposited at the landfill.

E. Final manifests and landfill receipts shall be provided to the Owner within 15 working days of the removal of the asbestos waste from the site by the waste hauler. The Abatement Contractor shall comply with current Federal, State and local regulations governing the handling, transportation and disposal of asbestos waste.

F. Contaminated water from the asbestos work area shall not be disposed of through the shower. Contaminated water must be filtered through a separate 5.0 micron filter system and discharged into the municipal sanitary sewer system, if allowed. If filtered waste water is not allowed to be discharged in the sanitary sewer system, contaminated water, filtered or not, shall be disposed of as asbestos contaminated waste.

3.10 FINAL CLEARANCE TESTING

A. Clearance air sampling, *if applicable to the project*, may be performed using PCM methodology utilizing aggressive air sampling techniques as required by Industrial Code Rule 56. The clearance air samples shall be considered satisfactory when every PCM air sample result demonstrates an airborne concentration of total fibers below 0.01 fibers per cubic centimeter (f/cc), or background level, whichever is greater.

1. If any PCM clearance air sample result indicates an airborne asbestos fiber concentration at or above 0.01 f/cc or the background level, whichever is greater, than the Abatement Contractor shall re-clean the affected work area in accordance with Industrial Code Rule 56, and another set of PCM clearance air samples shall be collected and analyzed.

2. When PCM clearance tests indicate non-compliance with Contract Documents, the Abatement Contractor shall incur all costs associated with re-cleaning of the work area, additional air sampling and analysis until compliance is achieved.

B. Final clearance air sampling *if applicable to the project* shall be performed using TEM methodology in lieu of or in addition to PCM clearance sampling, utilizing aggressive air sampling techniques as required by Industrial Code Rule 56. The final clearance air samples shall be considered satisfactory when the average TEM asbestos fiber concentration for five air samples collected inside a large work area does not exceed 70 structures per square millimeter (s/mm^2).

1. If the average TEM asbestos fiber concentration for five air samples collected inside a large work area exceeds 70 s/mm^2 then the Abatement Contractor shall re-clean the affected work area in accordance with Industrial Code Rule 56, and another set of TEM clearance air samples shall be collected and analyzed.

2. When TEM clearance tests indicate non-compliance with Contract Documents, the Abatement Contractor shall incur all costs associated with re-cleaning of the work area, additional air sampling and analysis until compliance is achieved.

C. Testing requested by the Abatement Contractor for his information and/or convenience shall be paid for by the Abatement Contractor.

3.12 RESTORATION OF FINISHES

A. After clearance air testing has been achieved, the Abatement Contractor shall remove critical barriers, decontamination enclosure systems, negative air exhaust systems, and restore power affected by the abatement work.

B. Temporary power shall be disconnected, power lock-outs removed and power restored. All temporary plumbing shall be removed.

C. After the Abatement Contractor has completely removed equipment and materials from the work area, the Building Owner and/or the Environmental Consultant shall conduct an inspection (final walk-through) of the work area(s) to ensure it is in an acceptable condition.

D. Finishes, landscaping, structures and/or equipment damaged by the Abatement Contractor shall be restored. Finishes unable to be restored shall be replaced by the Contractor under this Contract at no additional cost to the Owner.

3.13 SATISFACTORY COMPLETION OF WORK

A. The asbestos abatement work is complete upon fulfilling the following:

1. Removal of identified ACM and other related materials, and equipment as specified in this Section and the Asbestos Removal Plans**.**

2. Achieving satisfactory PCM/TEM clearance air sampling analytical results as specified by the Contract Documents and as required by all applicable codes, rules, and regulations, *if applicable to the project,* or satisfactory visual inspection of the work area(s).

3. Removing all asbestos abatement equipment and materials from the site.

4. Disposing of all removed asbestos waste material and related construction and demolition debris at an approved waste disposal landfill/facility. Submit waste shipment record forms signed by the Abatement Contractor, waste hauler, and landfill operator for each shipment of asbestos waste removed from the site.

B. Repairing and/or replacing damaged architectural finishes, mechanical systems, and/or equipment, except those which are specified for demolition, alteration, or removal.

C. The work under this section shall include but is not limited to the execution of the following principal items as they apply to Prime Contractors for Project Closeout:

1. Consent of surety for final payments.

2. Assurance, satisfactory to the Owner that unsettled claims will be settled and that work not completed and accepted will be completed without any undue delay.

3. Guaranties, Warranties and Bonds required by the General Conditions and any other extended guaranties or warranties stated in the Technical Sections of the Specifications.

END OF SECTION

Appendix A

PRE-RENOVATION SURVEY FOR HAZARDOUS MATERIALS

2021 CAPITAL PROJECT

1. PART 1 - GENERAL

1.01 SUMMARY OF WORK

A. A Pre-Renovation Survey for Hazardous Materials for each facility, prepared by Energy & Environment, LLC dated April 28, 2025, is provided in the "Information for Bidders" and shall be utilized by the Abatement Contractor and any other contractor in conducting their work. The report included investigations at the Main School Building for asbestos containing materials, lead-based paint and PCB containing caulks. The following is a summary of components treated with lead-based paint, varnish or glazing to be impacted by planned renovations. Contractors shall comply with all state and federal regulations and the contract documents when disturbing lead-based paint.

Lead Based Paint Sample Analysis Summary – DeRuyter Main School Building

Sample	Location	Source	Substrate	Feature	Condition	Color	Pb Conc. (mg/cm^2)
1	Boiler Room	Stairs	Metal	Handrail	Good	Brown	0.3
9	Compressor Room	Ceiling	Steel	I-Beam	Good	Black	1.5
10	Compressor Room	Door	Steel	Door Frame	Good	Red	0.4
15	Classroom 138	Door	Metal	Foor Frame	Good	Brown	1.2
19	Classroom 138	Casework	Laminate	Countertop	Good	Olive/Green	0.5
21	Classroom 137	Door	Metal	Door Frame	Good	Brown	3.6
27	Classroom 134	Door	Metal	Door Frame	Good	Brown	2.1
35	Boy's Restroom	Wall	Ceramic	4" x 6" Wall Tile	Good	Beige/Brown	0.3
49	Reading Room 130	Door	Metal	Door Frame	Good	Brown	0.2
51	Gymnasium	Door	Metal	Door Frame	Good	Brown	0.2
61	Stairwell	Stairs	Metal	Handrail	Good	Brown	2.1
73	Stairwell	Stairs	Metal	Handrail	Good	Brown	0.8
74	Stairwell	Stairs	Metal	Stringer	Good	Brown	2.3
75	Stairwell	Stairs	Metal	Baluster	Good	Brown	1.7
88	Girl's Restroom	Wall	Wood	Pipe Chase Door	Good	White	0.2
94	Boy's Restroom	Wall	Wall	Pipe Chase Door	Good	White	0.3
95	Stairwell	Stairs	Metal	Handrail	Good	Brown	1.8
96	Stairwell	Stairs	Metal	Baluster	Good	Brown	2.3
97	Stairwell	Stairs	Metal	Stringer	Good	Brown	2.6
98	Stairwell	Stairs	Plaster	Wall	Good	White	0.4
103	Front/Main Foyer	Security Booth	Plaster	Wall	Good	Beige	0.3
104	Front/Main Foyer	Security Booth	Wood	Cove Base	Good	Red	0.6
112	Old Gym/Auditorium	Stage	Plaster	Wall	Good	Grey	0.3
113	Old Gym/Auditorium	Stage	Plaster	Wall	Good	Red	0.2
114	Old Gym/Auditorium	Stage	Plaster	Wall	Good	Beige	0.1
116	Stage	Stairs	Metal	Handrail	Good	Light Brown	0.7
122	Auditorium Seating	Guardrail	Metal	Rail	Good	Red	0.6
127	Science Rm 101 (Chorus)	Ceiling	Steel	I-Beam	Good	Orange	2.4
128	Science Rm 101 (Chorus)	Ceiling	Steel	I-Beam	Good	Brown	1.9
157	Exterior Door Foyer	Stairs	Metal	Handrail	Good	Brown	1.2

Sample	Location	Source	Substrate	Feature	Condition	Color	Pb Conc. (mg/cm^2)
162	Classroom 116	Casework	Laminate	Countertop	Good	Wood Stain	0.3
166	Classroom 120	Casework	Laminate	Countertop	Good	Wood Stain	0.3
170	2nd Floor - Girls Restroom	Ceiling	Steel	I-Beam	Good	Brown	2.4
183	2nd Floor - Stairwell	Stairs	Metal	Baluster	Good	Brown	0.8
184	2nd Floor - Stairwell	Stairs	Metal	Handrail	Good	Brown	0.6
196	2nd Floor Boy's Restroom	Wall	Steel	Ladder - to roof	Good	Brown	0.3
197	2nd Floor - Stairwell	Stairs	Metal	Baluster	Good	Brown	1.6
198	2nd Floor - Stairwell	Stairs	Metal	Handrail	Good	Brown	0.9
199	2nd Floor - Stairwell	Stairs	Metal	Stringer	Good	Brown	0.4
213	Classroom 202	Ceiling	Steel	I-Beam	Good	Black	1.9
214	Corridor	Ceiling	Steel	I-Beam	Good	Black	2.3

B. Demolition activities that will disturb LBP creating the potential for lead exposure to workers and building occupants shall comply with the conditions specified herein. All contractors disturbing LBP shall comply with the US Environmental Protection Agency's Renovation, Repair and Painting Rule (RRP), OSHA's occupational exposure to lead under 29 CFR 1926.62, the Lead in Construction Standard and the New York State Education Department's Regulations Part 155.5, "Uniform Safety Standards for School Construction and Maintenance Projects. Any contractor disturbing painted surfaces shall comply with all the requirements of this specification as described above and as referenced in Section 1.2 of this specification. The intent is for the Abatement Contractor to protect his workers and building occupants from exposure to lead during demolition and/or renovation activities.

C. The Contractor shall provide labor, materials, tools, equipment and services necessary to protect workers and building occupants from lead exposure.

D. New York State Department of Environmental Conservation (NYSDEC) considers lead based paint in building components within a structure scheduled for demolition as construction & demolition (C&D) debris, and subject to applicable disposal requirements.

E. The Contractor shall dispose of C&D debris at a municipal landfill facility that accepts such C&D debris and is solely responsible for all laboratory analyses and costs required for waste characterization and proper disposal.

F. Work disturbing LBP shall be completed ancillary to work performed by others and is to be coordinated with the Owner, Construction Manager and others. Exact quantities and locations of lead-treated components to be removed, shall be determined by the Contractor at the time of bidding. ***The Abatement Contractor must satisfy himself as to the quantity of waste requiring removal and disposal and base his bid accordingly.***

G. All work shall be performed in accordance with this specification and applicable state and federal regulations. *Dry Sweeping of loose and pealing paint debris will not be permitted.* Debris must be picked up using a self-contained vacuum system, such as a commercial vacuum equipped with a High Efficiency Particulate Air (HEPA) filter, designed to evacuate wet or dry materials in an enclosed, controlled environment.

H. Waste material shall be contained, transported and disposed of in accordance with all applicable federal and state regulations.

1. 1.02APPLICABLE REGULATIONS

A. United States Environmental Protection Agency (USEPA)

1. 40 CFR Part 260 - Hazardous Waste Management System: General
2. 40 CFR Part 261 - Identification and Listing of Hazardous Waste.
3. 40 CFR Part 262 - Standards Applicable to Generators of Hazardous Waste.

4. 40 CFR Part 263 - Standards Applicable to Transporters of Hazardous Waste.
5. 40 CFR Part 264 - Standards for Owners and Operators of Hazardous Waste Treatment Storage, and Disposal Facilities.
6. 40 CFR Part 265 - Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities.
7. 40 CFR Part 266 - Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities.
8. 40 CFR Part 268 - Land Disposal Restrictions.
9. 40 CFR Part 270 - EPA Administered Permit Programs: The Hazardous Waste Permit Program.
10. 40 CFR Part 745, Subpart L - Lead-Based Paint Activities.
11. 40 CFR Part 745, Subpart E – Residential Property Renovation.

B. United States Department of Transportation (DOT)

1. 49 CFR 171 - General Information, Regulations, and Definitions.
2. 49 CFR 172 - Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements.
3. 49 CFR 173 - Shippers - General Requirements for Shipments and Packaging.

C. New York State Department of Environmental Conservation (DEC)

1. 6 NYCRR 360 - Solid Waste Management Facilities.
2. 6 NYCRR 364 - Waste Transporter Permits.
3. 6 NYCRR 370 - Hazardous Waste Management System: General.
4. 6 NYCRR 371 - Identification and Listing of Hazardous Wastes.
5. 6 NYCRR 372 - Hazardous Waste Manifest and Related Standards for Generators, Transporters and Facilities.
6. 6 NYCRR 373 - Hazardous Waste Treatment, Storage and Disposal Facility Permitting Requirements.
7. 6 NYCRR 376 - Land Disposal Restrictions.

D. Occupation Safety and Health Administration (OSHA)

1. 29 CFR 1926.62 - Construction Standard for Lead.

1.03 LEAD HAZARD

A. Specific work practices may release lead in the form of dust, fumes or mist into the air or onto surrounding surfaces. Only the Contractor can reduce the potential for lead exposure.

B. Lead is a toxic substance which may enter the body by breathing or swallowing lead dust, fumes or mists. If food, cigarettes, or hands have lead on them, lead may be ingested or inhaled. Once in the body, lead enters the bloodstream and may be carried to all parts of the body. The body can eliminate some of this lead, but if there is continued lead exposure, the body absorbs and stores more lead than it can eliminate. This stored lead may cause irreversible damage to cells, organs and whole body systems. After exposure stops, it takes months or even years for all lead to be removed from the body.

C. Exposure to lead may affect each person differently. Even before symptoms appear, lead may cause unseen injury to the body. During early stages of lead poisoning, mild symptoms may be overlooked as everyday medical complaints, including:

Loss of appetite
Trouble sleeping
Irritability
Fatigue
Headache
Joint and muscle aches
Metallic taste
Decreased sex drive
Lack of concentration
Moodiness

D. Brief intense exposure or prolonged overexposure may result in severe damage to your blood-forming, nervous, urinary and reproductive systems. Some noticeable medical problems include:

Stomach pains
Weakness of Extremities
High blood pressure
Tremors
Convulsions or seizures
Anemia

Nausea *Constipation or diarrhea*

E. The Contractor's site supervisor should be cognizant of all these symptoms. If a worker develops such symptoms he shall be removed from the work area immediately and not be allowed to return to the removal area until a physician performs blood lead sampling and determines that the worker is not suffering from lead exposure.

1.04 GENERAL REQUIREMENTS

A. The following general requirements apply to the Project and include, but are not necessarily limited to the following:

1. Respiratory and Personnel Protection.

2. Medical Examinations.

3. Temporary shower/washroom facility with adequate storage area for personnel belongings.

4. Provisions for hot and cold running water for shower/washroom facilities.

5. Use of engineering controls as necessary to reduce lead exposure.

1.05 PROJECT SUBMITTALS

A. Prior to the start of construction, the Contractor shall submit the following documents and records should his work require the disturbance and/or abatement of identified LBP materials.

1. WORKPLAN: The Contractor shall submit a work plan for the lead work commensurate with the requirements of the OSHA Construction Standard and EPA regulations. The plan shall include, but not be limited to, identifying detailed aspects of how the Contractor will handle, containerize, transport, and dispose of LBP materials or how Contractor shall minimize lead dust exposure.

EQUIPMENT: Submit manufacturer's certification and information for all equipment to be used on this project.

3. EMPLOYEES: Submit documentation that all employees, if performing abatement of lead painted materials or lead contaminated materials, have received appropriate training and medical examinations and have successfully passed a fit test for respiratory protection.

4. DISPOSAL: Submit documentation that all required permits, disposal location, and arrangements for transportation and disposal of lead-contaminated waste have been obtained. Submit written description and blank forms of waste manifest system to be used. Submit the name and credentials for the independent laboratory performing TCLP testing, if required for disposal, on the lead-contaminated waste generated at the project.

1.06 DEFINITIONS

A. Action level, as defined by OSHA 29 CFR Part 1926.62, means employee exposure, without regard to the use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter (30 $\mu g/m^3$) of air calculated as an 8-hour time-weighted average (TWA).

B. Construction & Demolition (C&D) debris, as defined by the NYDEC means uncontaminated solid waste resulting from the construction, remodeling, repair and demolition of utilities, structures and roads; and uncontaminated solid waste resulting from land clearing. Such waste includes, but is not limited to bricks, concrete and other masonry materials, soil, rock, wood (including painted, treated and coated wood and wood products), land clearing debris, wall coverings, plaster, drywall, plumbing fixtures, non-asbestos insulation, roofing shingles and other roof coverings, asphaltic pavement, glass, plastics that are not sealed in a manner that conceals other wastes, empty buckets ten gallons or less in size and having no more than one inch of residue remaining on the bottom, electrical wiring and components containing no hazardous liquids, and pipe and metals that are incidental to any of the above.

C. Competent person, as defined by OSHA 29 CFR Part 1926.62, means one who is capable of

identifying existing and predictable lead hazards in the surroundings or working conditions and who has authorization to implement corrective measures to eliminate such lead hazards.

D. LBP, as defined by the U.S. Environmental Protection Agency (USEPA) and HUD means paint containing 0.50% or more lead by weight.

E. Lead, as defined by OSHA 29 CFR Part 1926.62, means metallic lead at any detectable level.

F. Permissible exposure limit (PEL), as defined by OSHA 29 CFR Part 1926.62, means employee exposure, without regard to the use of respirators, to an airborne concentration of lead of 50 $\mu g/m^3$ calculated as an 8-hour TWA.

1.07 PERSONAL AIR SAMPLING & ANALYSIS

A. The Contractor shall conduct personal air sampling of his personnel, including daily 8-hr TWA air sampling/analysis, as required by 29 CFR Part 1926.62.

1.08 PROJECT MONITORING

A. The Owner shall hire an independent third-party Project Monitor to observe the lead work, and to conduct quality control sampling, clearance sampling and analysis.

2. PART 2 - PRODUCTS

2.01 MATERIALS

A. Adhesives: Duct tape, or similar and aerosol spray adhesives formulated to adhere to plastic sheeting, wood, metal.

B. Plastic Sheeting: 6-mil fire-retardant plastic sheeting and reinforced plastic sheeting for critical barriers, Decontamination Enclosure Systems, and work area surfaces as specified by the applicable regulations

C. Detergent Wash Solution: At least 5% tri-sodium phosphate (TSP) solution for cleaning.

D. Floor Sealant: Wax to seal vinyl tile floor or concrete sealer or durable non-lead deck enamel paint to seal porous concrete slab after final cleaning and prior to clearance dust-wipe sampling.

E. Sheathing & Framing: Sheathing having a thickness of 3/8-inch and 2" x 4" wood or metal framing shall be used for isolation barrier walls and for construction of Personal/Waste Decontamination Enclosure System.

3. 2.02 EQUIPMENT

A. Electrical Service: Electrical service with minimum 60-amp, 2-pole circuit breaker or fused disconnect sub-panel to connect to the Owner's electrical power source in compliance with NEMA, NECA, and UL standards; Warning signs at power outlets which are other than 110-120 volts; Polarized outlets for plug-in type outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets; Dry-type transformers, where required, to provide voltages necessary for work; Receptacle outlets equipped with ground-fault protection, reset button, and pilot light for plug-in connection of power tools and equipment; Grounded "hard-service" extension cords where exposed to abrasion or traffic and waterproof connectors to connect separate lengths; General service incandescent lamps with wattage for adequate illumination equipped with guard cages or tempered glass enclosures.

B. Fire Extinguishers: Multi-purpose ABC minimum rating to A40BC fire extinguishers in compliance with NFPA Standard 10 "Standard for Portable Fire Extinguishers".

C. Negative-Air Ventilation: Negative-air pressure, relative to areas outside of a work area, shall be maintained at all times in all work areas during the lead abatement work. A power supply shall be available to satisfy the requirements of the total of all negative-air ventilation units. Ducts, of at least equivalent shape and dimension as that of each negative-air pressure ventilation unit exhaust, shall be used to exhaust to the outside of the building. All fans, ducts, and joints shall be sealed, braced, and supported to maintain an airtight system.

D. Protective Clothing: Coveralls, work boots, hard hats, eye protection, and work gloves.

E. Respirator Filters: HEPA filter cartridges certified by NIOSH for “Radionuclides, Radon Daughters, Dust, Fumes, Mists including Asbestos-Containing Dusts and Mists” and color-coded in accordance with ANSI Z228.2.

F. Respiratory Protection: Negative-pressure, half-face, air-purifying respirators and replacement HEPA filters for respirators.

G. Shower Head & Controls: Factory-made, adjustable shower head, and internal water temperature, flow rate, and shut off controls.

H. Shower Unit: Leak-tight shower unit with 3’ x 3’ x 6’ fiberglass or metal drain pan, and hose bib mounted approximately four feet above drain pan. The shower will be suitably arranged for complete showering during decontamination with a sufficient supply of soap at all times.

I. Sump Pump: Submersible sump pump with integral float switch designed to pump twice the flow capacity of all showers or hoses supplying water to the sump through specified filtration system.

J. Vacuums: High Efficiency Particulate Air (HEPA) filters to remove particles of 0.3 micron or larger at a 99.97% efficiency rate or greater, and various size vacuum brushes and angular attachments.

K. Waste Storage: Enclosed dumpsters, drums, or other containers for storage of lead waste materials with appropriate warning signs affixed to the exterior of each container.

L. Wastewater Filtration System: Lead abatement wastewater shall be drained, collected, and filtered through a three-stage filter system prior to discharge. All wastewater shall pass through a series of filters of progressively smaller pore size before passing through a final third stage filter with at least a 5.0-micron pore size collection capability.

M. Water Service: Heavy-duty hoses furnished with backflow protection to provide water to the work area and Decontamination Enclosure Systems from the Owner’s water supply

PART 3 - EXECUTION

3.01 BUILDING ISOLATION AND SIGNAGE

A. Only the Contractor and the Owner’s representatives will be allowed in the work area where lead-based paint activities may result is a respirable dust environment above the PEL. Anyone entering the work area will don appropriate respiratory protection and disposable coveralls.

B. Warning signs shall comply with 29 CFR 1926.62 and applicable regulations.

30.2 EXPOSURE ASSESSMENT MONITORING

A. The Contractor shall perform lead exposure assessment air monitoring as required by OSHA 29 CFR 1926.62. Worker exposures shall be made from breathing zone air samples that are representative of the TWA exposures of each worker.

B. Representative TWA worker exposures shall be determined on the basis of one or more samples representing full-shift exposure for workers in each work area.

C. For any one specific operation which will be performed by certified workers, the Abatement Contractor may demonstrate that worker exposures will be below the PEL by data which conform to the following criteria:

1. Objective data demonstrating that the product or material containing lead or the activity involving such product or material cannot release airborne fibers in concentrations exceeding the PEL under those work conditions having the greatest potential for releasing lead; or

2. Where the Contractor has monitored prior lead jobs for the PEL within 12 months of the

current job; the data were obtained during operations conducted under workplace conditions "closely resembling" the processes, type of material, control methods, work practices, and environmental conditions used and prevailing in the Contractor's current operations; the operations were conducted by workers whose training and experience are no more extensive than that of workers performing the current job; and the data show that under the conditions prevailing and which will prevail in the current workplace there is a high degree of certainty that worker exposures will not exceed the PEL; or

3. The results of initial exposure monitoring of the current job made from breathing zone air samples that are representative of the TWA exposures of each worker covering operations which are most likely during the performance of the entire lead job to result in exposures over the PEL.

D. The Contractor shall conduct daily air monitoring that is representative of the exposure of each worker who is assigned to work within a regulated work area, unless the Contractor has made a negative exposure assessment for the entire operation.

E. The Contractor shall institute exposure monitoring whenever there has been a change in process, control equipment, personnel, or work practices that may result in new or additional exposures above the PEL or when there is reason to suspect that a change may result in new or additional exposures above the PEL. Such additional monitoring is required regardless of whether a "negative exposure assessment" was previously produced for a specific job.

3.03 PRE-ABATEMENT REQUIREMENTS

A. Site Security & Use: The Contractor shall take all necessary precautions to protect all workers, subcontractors, consultants, authorized visitors, and building occupants from exposure to lead/lead dust; and shall limit use of the site to only those areas where the lead abatement work is specified.

B. Post warning signs at all appropriate work area barriers where LBP abatement is anticipated displaying the following.

WARNING
LEAD WORK AREA
NO SMOKING OR EATING

C. Electrical Service: Provide grounded temporary electrical service of sufficient size, capacity, and power to accommodate work, and provide overload-protected disconnect switches for each temporary circuit.

D. Ventilation Systems: Disable ventilation systems bringing air into or out of an abatement work area by disconnecting wires, removing circuit breakers, and installing lockable switches that will prevent accidental or premature restarting of equipment.

E. Temporary Lighting: Provide lighting as required supplying a 50-foot candle minimum light level. Provide a minimum of one, 200-watt incandescent lamp per 1,000 SF of floor area to provide uniform lighting throughout each work area.

F. Temporary Heat: Maintain a minimum temperature of 70 degrees Fahrenheit throughout the work area and Decontamination Enclosure Systems.

3.04 WORK AREA PREPARATION

A. Regulated Work Area Enclosure: Lead abatement work, *if applicable to the project*, shall be conducted within a negative-pressure enclosure to prevent lead/lead dust and lead contaminated debris from contaminating adjacent non-work areas, workers, and other persons at the site. The work area enclosure system shall be constructed of 6-mil fire-retardant plastic sheeting sealed with duct tape and attached to rigid framing material and furnished with a curtained doorway to provide ingress/egress. The work area enclosure system shall be appropriately sized for the scope of the lead abatement work. Access to the regulated work area enclosure shall be limited to authorized persons.

B. Isolation Barriers: Install isolation barriers at windows, doorways, ducts, grilles, diffusers and any other openings to the regulated work area enclosure, constructed of two layers of 6-mil fire-

retardant plastic sheeting sealed with duct tape. All seams in system components that pass through the work area shall be sealed. Doorways and corridors which will not be used for passage during the lead abatement work shall also be sealed. Construction of isolation barriers to separate the work area from the remainder of the site by shall be accomplished as follows:

1. Walls shall be constructed of wood or metal framing to support barriers in all openings larger than 32 square feet, except where any one dimension is one foot or less.

2. Sheathing material of at least 3/8-inch thickness shall be applied to the work side of the barrier.

3. Edges of the partition shall be caulked at the floor, ceiling, walls, and fixtures to form an airtight seal.

4. The work side of the partition shall be covered with two layers of 6-mil fire-retardant plastic sheeting with staggered joints and sealed.

5. All floor, wall and ceiling surfaces (excluding such surfaces which are subject to the abatement work) shall be covered with two layers of 6-mil fire-retardant plastic sheeting. The floor shall be plasticized first and the plastic sheeting shall extend up the walls at least 12 inches on all sides. The walls shall then be plasticized by applying plastic sheeting from ceiling to floor, and overlapping the floor sheeting by at least 12 inches. This process shall be repeated for the second layer of plastic sheeting for the floor and walls. All seams within a layer shall be separated by a distance of at least six feet and sealed airtight, and all seams between layers shall be staggered.

C. Personal/Waste Decontamination Enclosure System: The Abatement Contractor shall place all tools, equipment, and other materials in the work area, then construct or provide for an attached Personal/Waste Decontamination Enclosure System.

1. Construct a Clean Room sized to accommodate all personnel and authorized persons. Benches, lockers, and hooks shall be provided for street clothes, and shelves shall be provided for storing respirators. The Clean Room shall not be used for the storage of tools, equipment, or materials, and shall not be used for office space. The Clean Room shall be locked during non-work hours.
2. Construct a Shower Room containing a shower head supplied with hot and cold water adjustable at the tap. The Shower Room shall be separated from the Clean Room and the Equipment/Waste Wash Room by airlocks constructed of 6-mil, fire-retardant plastic sheeting. Soap, shampoo, and towels shall be available at all times. Contaminated filters shall be disposed of as lead-contaminated waste.

3. Construct an Equipment/Waste Wash Room for the storage of equipment and tools after decontamination. The Equipment/Waste Wash Room shall be separated from the Work Area and the Holding Area by airlocks constructed of 6-mil fire-retardant plastic sheeting. A walk-off pan filled with water shall be located outside the Equipment/Waste Wash Room for persons to clean foot coverings. A drum lined with a 6-mil plastic bag shall be located in the Equipment/Waste Wash Room for the collection of clothing.

4. Construct a Holding Area as a drop location for lead waste/demolition debris passed from the Equipment/Waste Wash Room. The Holding Area shall be located so that lead-containing waste/debris can be passed from the Equipment/Waste Wash Room into the Holding Area. The Holding Area shall be separated from the Equipment/Waste Wash Room by an airlock constructed of a three layer curtain system of at least 6-mil fire-retardant plastic sheeting. The Holding Area shall be locked during non-work hours.

3.05 WORK AREA ENTRY/EXIT

A. The Contractor shall provide an entry/exit log which shall be posted at the entrance to each regulated work area. All persons who enter a regulated work area shall sign the entry/exit log upon every entry and exit. All persons, before entering a regulated work area, shall read and be familiar with all posted regulations and personal protection requirements.

B. The Contractor shall restrict unauthorized persons from entering regulated work areas and avoid lead/lead dust and lead contaminated debris from passing beyond the regulated work areas.

Should areas beyond a regulated work area become contaminated with lead dust or lead contaminated debris as a result of the work, the Contractor shall clean those areas in accordance with the applicable regulations. Such cleaning or decontamination event conducted by the Contractor shall be performed at no additional cost to the Owner.

C. Abatement workers and authorized persons shall enter and exit regulated work areas through a curtained doorway. Each time a regulated work area is entered, two disposable suits/coveralls and clean respirators shall to be worn.

D. All persons shall read and be familiar with all posted regulations and personal protection requirements, including work area entry/exit procedures and emergency procedures, before entering a regulated work area.

E. The Contractor shall provide personal protective equipment and respiratory protection to authorized persons entering regulated work areas until the work has been completed.

3.06 REMOVAL OF LEAD

A. The Contractor is not required to remove adhered, loose or peeling paint from building surfaces impacted by scheduled demolition activities, but shall minimize, contain, and dispose of lead dust created by his work in accordance with all applicable codes & rules.

B. The Contractor shall take steps to prevent lead/lead dust from deposition on the land. Such lead waste shall be collected and disposed of as C&D debris.

3.07 WORK AREA CLEANING & DECONTAMINATION

A. The Contractor shall remove all lead-containing waste material/debris, demolition debris, and all tools and equipment from the regulated work area.

B. HEPA vacuum and clean each layer of plastic on the floors, walls, and ceilings using TSP detergent solution, and remove each layer of plastic after cleaning is completed

C. HEPA vacuum and clean remaining floor, wall, and ceiling surfaces using TSP detergent wash solution and continue cleaning until there is no visible lead/lead dust or debris inside the regulated work area.

D. Apply sealant to remaining floor surface within regulated work area, vacate and seal access to work area, and wait one hour to allow any lead dust to settle before conducting clearance dust-wipe sampling.

E. Abatement Project Monitor, hired by the Owner, will conduct lead-wipe clearance sampling and analyses. Wipe sampling will be conducted by an EPA-certified Lead Risk Assessor and clearance sampling will be conducted in accordance with HUD guidelines.

3.08 HANDLING AND DISPOSAL OF LEAD

A. Hazardous Waste

1. The Contractor shall follow all federal and state regulations for waste handling, containerizing, transporting, and disposing of lead-based paint.

2. The Contractor shall remove lead-contaminated waste from the building in accordance with specification requirements. Lead waste shall be deposited directly into waste receptacles (i.e., drums, enclosed dumpster, etc.) that will be used to transport the waste.

3. The Contractor is responsible for providing all waste receptacles required for disposal. All waste temporarily stored on site shall be secured to prevent against unauthorized entry and vandalism. ***The Contractor shall be responsible for all TCLP testing to properly characterize the lead-contaminated waste for proper off-site disposal.***

4. The Contractor shall establish a manifest system that meets federal and state regulations and accounts for all waste at all times.

5. The transporter must possess an approved waste haulers permit in accordance with the NYS DEC. Hazardous waste manifest must be completed by the Contractor.

6. The Contractor shall provide the Owner with copies of the waste manifest form and written acknowledgement from the landfill that they are authorized by the EPA and the state where they are located, to accept and dispose of hazardous waste.

7. Final manifest and disposal receipts must be provided to the Owner and/or Owner's representative within fourteen (14) days of the removal of the waste from the site.

3.09 PROJECT CLOSEOUT

A. Prior to final payment, and before the issuance of a final certificate for payment in accordance with the provisions of the contract documents, Contractor shall comply with the following.

1. The Contractor shall provide copies of *all* laboratory reports for air sampling and TCLP analyses as applicable.

2. Final disposal receipts for all waste generated at the project.

3. The Contractor shall have removed all equipment and materials applicable to the work site.

END OF SECTION

-- 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 cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

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

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

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Architect.

1.5 INFORMATIONAL SUBMITTALS

Coordinate "Qualification Data" Paragraph below with qualification requirements in Section 014000 "Quality Requirements" and as supplemented in "Quality Assurance" Article.

A. Material Certificates: For each of the following, signed by manufacturers:

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

B. Material Test Reports: For the following, from a qualified testing agency:

1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

C. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).

2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

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

B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and as follows:

1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301 (ACI 301M).

2. ACI 117 (ACI 117M).

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

a. High-density overlay, Class 1 or better.

b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.

c. Structural 1, B-B or better; mill oiled and edge sealed.

d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
2. Furnish ties that, when removed, leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

C. Galvanized Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) deformed bars.

D. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn.

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

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.5 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C 150/C 150M, Type I/II
2. Fly Ash: ASTM C 618, Class F
3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
4. Blended Hydraulic Cement: ASTM C 595/C 595M cement.
5. Silica Fume: ASTM C 1240, amorphous silica.

C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C 260/C 260M.

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

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

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

F. Water: ASTM C 94/C 94M and potable.

2.6 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).

2.7 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A, Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.8 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

2.9 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

D. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

E. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.10 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.11 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 (ACI 301M).

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Combined Fly Ash and Pozzolan: 25 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

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

1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings, Foundation Walls: Normal-weight concrete.

1. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days.
2. Maximum W/C Ratio: 0.50
3. Slump Limit: 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.

B. Interior Slabs-on-Grade: Normal-weight concrete.

1. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days.
2. Maximum W/C Ratio: 0.45
3. Minimum Cementitious Materials Content: 470 lb/cu. yd. (279 kg/cu. m)
4. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

C. Exterior Slabs-on-Grade: Normal-weight concrete.

1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
2. Maximum W/C Ratio: 0.40
3. Minimum Cementitious Materials Content: 517 lb/cu. yd. (306.9 kg/cu. m)
4. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.

2.13 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M).

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

1. Class A, 1/8 inch (3.2 mm)for smooth-formed finished surfaces.
2. Class C, 1/2 inch (13 mm)for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.

2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.

2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.

2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORING AND RESHORING INSTALLATION

A. Comply with ACI 318 (ACI 318M) and ACI 301 (ACI 301M) for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR-RETARDER INSTALLATION

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder according to manufacturer's written instructions.

3.6 STEEL REINFORCEMENT INSTALLATION

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

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

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

3.7 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.

2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.

3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least [one-fourth] of concrete thickness as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.

2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.

3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 WATERSTOP INSTALLATION

A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.9 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M).

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.

2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).

3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.10 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view.

C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix 1 part portland cement and 1 part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

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

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in one direction.

1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

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

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated, exposed to view, or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

2. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch (3.2 mm).

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated or where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

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

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.12 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.

2. Construct concrete bases 6 inches (150 mm) high unless otherwise indicated, and extend base not less than 6 inches (150 mm) in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.

3. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.

4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.

5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.

6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.13 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 (ACI 301M) for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.

b. Continuous water-fog spray.

c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.

b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least [one] month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:

1. Steel reinforcement placement.
2. Headed bolts and studs.
3. Verification of use of required design mixture.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.
6. Verification of concrete strength before removal of shores and forms from beams and slabs.

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

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
    a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567/C 567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31/C 31M.
    a. Cast and laboratory cure three sets of two standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days. Retain the third set for 56 days minimum. Do not test unless directed by Engineer.
    a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting

agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.

13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 033000

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. Concrete masonry units.
2. Face brick.
3. Steel reinforcing bars.
4. Masonry joint reinforcement.
5. Ties and anchors.
6. Miscellaneous masonry accessories.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For the following:
1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."

C. Samples for Initial Selection:
1. Face brick, in the form of straps of five or more bricks.
2. Colored mortar.
3. Weep holes/vents.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Material Certificates: For each type and size of the following:
1. Masonry units.
   a. Include data on material properties.
   b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
   c. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
   d. For exposed brick, include test report for efflorescence according to ASTM C 67.
2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Pre-blended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.

5. Reinforcing bars.
6. Joint reinforcement.
7. Anchors, ties, and metal accessories.

C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109 for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

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

E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

A. Concrete masonry products used on this project shall be manufactured in accordance with the FM 2000 Program fostered by the New York State Concrete Masonry Association (NYSCMA). Concrete Masonry Block Producers providing FM 2000 compliant masonry materials are subject to random ASTM testing on quarterly basis. Testing is performed at the National Concrete Masonry Association (NCMA) laboratory to ensure compliance.

B. Block Producers not currently FM 2000 or NYSCMA Members can still apply for compliance to be eligible to provide products for this project by providing an 'accepted equivalent program' that includes the following submissions:
1. CMU Producer's written quality assurance program.
2. Documentation that CMUs have been tested yearly for conformance to ASTMC140 and ASTM C90.
3. Test results from Architect accepted third party testing agency per ASTM C140 demonstrating compliance to ASTM C 90 "Standard Specification for Load Bearing Concrete Masonry Units", except net area unit compressive strength must equal or exceed 2800 PSI at 28 days.
4. Test results from Architect accepted third party testing agency identifying compressive strength of masonry (f'_m) for CMU tested based on Section 1.4.B.2.b of "Specifications For Masonry Structures" (referenced by The "Building Code of New York State"). f'_m values shall be identified for CMU used with Type M or S Mortar and Type N Mortar.
5. Tests results from Architect accepted third party testing agency for ASTM C1314 "Standard Test Method for Compressive Strength of Masonry Prisms" showing 28 day prism test values of CMU's.
6. Test results from an Architect accepted testing agency for ASTM C426 "Standard Test Method for Linear Drying Shrinkage of Concrete Masonry Units" demonstrating compliance to ASTM C 90.
7. Letter on company stationery stating that all CMU supplied to project are from same "Lot" as CMU used in tests submitted. ASTM C 140 defines "Lot" …"As any number of Concrete Masonry Units of any configuration or dimension manufactured by the producer using the same materials, concrete mix design, manufacturing process, and curing method."

C. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

D. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

E. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

F. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

G. Fire Resistance Ratings: Where indicated, provide materials, and construction identical to those of assemblies with fire resistance ratings determined per ASTM E 119 by testing and inspecting agency, using equivalent concrete masonry thickness or other means acceptable to authorities with jurisdiction.

H. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build mockups for each type of exposed unit masonry construction typical exterior wall in sizes approximately 48 inches long x 48 inches high x full thickness, including face and backup wythes and accessories.
a. Include sealant filled joint at least 16 inches long in each mockup.
b. Include lower corner of window opening framed with cast stone trim at upper corner of exterior wall mockup. Make opening approximately 12 inches wide x 16 inches high.

c. Include Thru Wall flashing installed in 24 inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup; with 12 inch length of flashing left exposed to view (omit masonry above half of flashing).
d. Include metal studs, sheathing, veneer anchors, flashing with end dams, and weep holes in exterior masonry veneer wall mockup.

2. Erect mockups adjacent and parallel to existing surface, as directed by Architect.
3. Clean one half of exposed faces of mockups with masonry cleaner as indicated.
4. Protect accepted mockups from the elements with weather resistant membrane.
5. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

I. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing

J. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section PROJECT MANAGEMENT AND COORDINATION.
1. Discuss extent and location of mock-ups and sample panels, if requested by Architect.
2. Review requirements for masonry assemblies, including but not limited to surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details, installation procedures, testing and inspection procedures, protection, and repair.

1.8 DELIVERY, STORAGE, AND HANDLING

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

B. Store cementitious materials on elevated platforms, under cover, and in dry location. Do not use cementitious materials that have become damp. Sand must be stored on wood platform separated from soil so that hand shovels cannot accidentally mix soil in with sand.

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

D. Deliver pre-blended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store pre-blended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

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

1.9 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

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

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

A. Regional Materials: CMUs shall be manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide bullnose units for outside corners unless otherwise indicated.

C. CMUs: ASTM C 90.
1. Density Classification: Normal weight unless otherwise indicated.
2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

D. Concrete Building Brick: ASTM C 55.

2.3 CONCRETE AND MASONRY LINTELS

A. General: Provide one of the following:

B. Concrete Lintels: ASTM C 1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated.
1. Provide lintels with net-area compressive strength not less than CMUs.

C. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Division 03 Section CAST-IN-PLACE CONCRETE, and with reinforcing bars indicated.

D. Masonry Lintels: Pre-fabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 BRICK

A. General: Provide shapes indicated and as follows:
1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes and sizes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes and sizes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes and sizes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: ASTM C 216, Grade SW, Type FBS, unless noted otherwise.
1. Unit Compressive Strength: Provide units with minimum average net area compressive strength of 3000 psi.
2. Initial Rate of Absorption: Less than 20 g/30 sq. in. per minute when tested per ASTM C 67.
3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
4. Size (Actual Dimensions): 3-5/8 wide x 2-1/4 high x 7-5/8 inches long.(typical) or as required to suit project conditions.
5. Products:
    a. Match existing, as determined by Architect.

2.5 MORTAR AND GROUT MATERIALS

A. Regional Materials: Aggregate for mortar and grout, cement, and lime shall be extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

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

C. Mortar Cement: ASTM C 1329.
1. Products:
   a. Lafarge North America Inc.; Lafarge Mortar Cement.
   b. Architect approved equal.

D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with record of satisfactory performance in masonry mortar.
1. Products:
   a. Bayer Corporation, Industrial Chemicals Div.; Bayferrox Iron Oxide Pigments.
   b. Davis Colors; True Tone Mortar Colors.
   c. Solomon Grind-Chem Services, Inc.; SGS Mortar Colors.
   d. Architect approved equal.

E. Colored Cement Product: Packaged blend made from Portland cement and lime or mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
1. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
2. Pigments shall not exceed 10 percent of Portland cement by weight.
3. Pigments shall not exceed 5 percent of mortar cement by weight.
4. Products:
   a. Colored Portland Cement Lime Mix:
      1) Capital Materials Corporation; Riverton Portland Cement Lime Custom Color.
      2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
      3) Lafarge North America Inc.; Eaglebond.
      4) Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.
      5) Architect approved equal.
   b. Colored Masonry Cement:
      1) Capital Materials Corporation; Flamingo Color Masonry Cement.
      2) Essroc, Italcementi Group; Brixment-in-Color.
      3) Holcim (US) Inc.; Rainbow Mortamix Custom Color Masonry Cement.
      4) Lafarge North America Inc.; [Florida Custom Color Masonry] [or] [Magnolia Masonry Cement].
      5) Lehigh Cement Company; Lehigh Custom Color Masonry Cement.
      6) National Cement Company, Inc.; Coosa Masonry Cement.
      7) Architect approved equal.
   c. Colored Mortar Cement:
      1) Lafarge North America Inc.; Magnolia Superbond Mortar Cement.
      2) Architect approved equal

F. Aggregate for Mortar: ASTM C 144.
   a. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
   b. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
   c. White-Mortar Aggregates: Natural white sand or crushed white stone.
   d. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

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

H. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.

I. All Integral Water Repellent CMU shall be installed with the CMU manufacturer recommended Integral Water Repellent Mortar Admix.

J. Cold-Weather Admixture: Non-chloride, non-corrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Euclid Chemical Company (The); Accelguard 80.
   b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.

c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.
d. Architect approved equal..

K. Water: Potable.

2.6 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615 or ASTM A 996, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951.
1. Interior Walls: Hot-dip galvanized, carbon steel.
2. Wire Size for Side Rods: 0.148-inch diameter.
3. Wire Size for Cross Rods: 0.148-inch diameter.
4. Wire Size for Veneer Ties: 0.187-inch diameter.
5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
6. Provide in lengths of not less than 10 feet, with pre-fabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

D. Masonry Joint Reinforcement for Multiwythe Masonry:
1. Brick facing wythe requires adjustable (2 piece) type, ladder design, with one side rod at each face shell of back up wythe and separate ties that extend into facing wythe. Ties have two (2) hooks that engage eyes reinforcement and resist movement perpendicular to wall. Ties (Pintles) extend at least halfway through facing wythe but retain 5/8 inch minimum cover on outside face.
a. Similar to Hohmann & Barnard No. 180 Dub'l Loop-Lok Truss

2.7 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 641, Class 1 coating.
2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.
3. Stainless-Steel Wire: ASTM A 580, Type 304.
4. Galvanized Steel Sheet: ASTM A 653, Commercial Steel, G60 zinc coating.
5. Steel Sheet, Galvanized after Fabrication: ASTM A 1008, Commercial Steel, with ASTM A 153, Class B coating.
6. Stainless-Steel Sheet: ASTM A 666, Type 304.
7. Steel Plates, Shapes, and Bars: ASTM A 36.
8. Stainless-Steel Bars: ASTM A 276 or ASTM a 666, Type 304.

B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units.
2. Wire: Fabricate from 3/16-inch- diameter, hot-dip galvanized steel wire.
3. Wire: Fabricate from 3/16-inch- diameter, hot-dip galvanized steel wire

D. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel wire.
2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.187-inch- diameter, hot-dip galvanized steel wire.

E. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Corrugated Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from 0.060-inch- thick, steel sheet, galvanized after fabrication with dovetail tabs for inserting into dovetail slots in concrete and sized to extend to within 1 inch of masonry face.

F. Partition Top anchors: 0.105-inch- thick metal plate with 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

G. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.
   1. Corrosion Protection: Epoxy coating 0.020 inch thick.

H. Adjustable Masonry Veneer Anchors at Steel Stud Cavity Walls
   1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to metal studs, and as follows:
      a. Structural Performance Characteristics: Capable of withstanding 100 lb/f load in both tension and compression without deforming or developing play more than 0.05 inch.
   2. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches wide x 6 inches long, with screw holes top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation or sheathing; and raised rib stiffened strap, 5/8 inch wide x 6 inches long, stamped into center to provide slot between strap and plate for inserting wire tie.
      a. Wire Ties: Triangular, rectangular or T shaped wire ties fabricated 0.25 inch diameter, hot dip galvanized steel wire.
      b. Basis of Design is Hohmann & Barnard, Inc.; X-Seal Anchor™ (Replacing DW-10-X) with Textroseal, other products include;
         1) Dayton Superior Corporation, Dur-O-Wal Division; D/A 210 with D/A 700-708.
         2) Heckmann Building Products Inc.; 315-D with 316 or Pos-I-Tie.
         3) Wire-Bond; 1004, Type III or RJ-711.
   3. Polymer Coated, Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 diameter by length required to penetrate steel stud flange with not less than 3 exposed threads, and with organic polymer coating with salt spray resistance to red rust of more than 800 hours per ASTM B 117.
      a. Products:
         1) ITW Buildex; Teks MaxiSeal with Climaseal finish.
         2) Textron Inc., Textron Fastening Systems; Elco Dril-Flex with Stalgard finish.
   4. Stainless Steel Drill Screws for Steel Studs: Proprietary fastener consisting of carbon steel drill point and 300 Series stainless steel shank, complying with ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads.
      a. Products:
         1) Dayton Superior Corporation, Dur-O-Wal Division; Stainless Steel SX Fastener.
         2) ITW Buildex; Scots long life Teks

I. ITW Buildex; Scots long life Teks

2.8 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.

B. Dovetail Slots in Concrete: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.034-inch, galvanized steel sheet.

C. Anchor Bolts: L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of dimensions indicated.

D. Post-installed Anchors: Torque-controlled expansion anchors or chemical anchors.
   1. Load Capacity: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
   2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 unless otherwise indicated.
   3. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.9 EMBEDDED THRU WALL FLASHING MATERIALS

A. Flexible Flashing: For flashing not exposed to exterior, use the following, unless otherwise indicated:
   1. Copper Laminated Flashing: 7 oz. /sq. ft. copper sheet bonded with asphalt between 2 layers of glass fiber cloth. Use only where flashing is fully concealed in masonry and in combination with Aluminum “Thru Wall” Custom 2 Piece Counter Flashing when supplied by Roofer for intersections of Roof and Masonry/Parapet Walls.
      a. Products:
         1) Advanced Building Products Inc.; Copper Fabric Flashing.
         2) AFCO Products Inc.; Copper Fabric.
         3) Hohmann & Barnard, Inc.; H & B C-Fab Flashing.
         4) Phoenix Building Products; Type FCC-Fabric Covered Copper.

5) Polytite Manufacturing Corp.; Copper Fabric Flashing.
6) Sandell Manufacturing Co., Inc.; Copper Fabric Flashing.
7) York Manufacturing, Inc.; York Copper Fabric Flashing.

2. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch.
   a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      1) Advanced Building Products Inc.; Peel-N-Seal.
      2) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
      3) Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Barrier Thru-Wall Flashing.
      4) Fiberweb, Clark Hammerbeam Corp.; Aquaflash 500.
      5) Grace Construction Products, W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.
      6) Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
      7) Hohmann & Barnard, Inc.; Textroflash.
      8) W. R. Meadows, Inc.; Air-Shield Thru-Wall Flashing.
      9) Sandell Manufacturing Co., Inc.; Sando-Seal.
      10) Williams Products, Inc.; Everlastic MF-40.
   b. Accessories: Provide pre-formed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

B. Application: Unless otherwise indicated, use the following:
1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge.
4. Where flashing is fully concealed, use flexible flashing.

C. Solder and Sealants for Sheet Metal Flashings: As specified in Division 07 Section SHEET METAL FLASHING AND TRIM.
1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
3. Elastomeric Sealant: ASTM C 920, chemically curing silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

D. Through Wall Flashing Where Exposed to Drip at Exterior: Provide stainless steel drip edge bonded to concealed embedded flashing. Provide continuous stainless steel through wall flashing at retrofit conditions as detailed.

E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates

2.10 MISCELLANEOUS MASONRY ACCESSORIES

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

B. Pre-formed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

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

D. Weep/Vent Products: Use the following, unless otherwise indicated:
1. Cellular Plastic Weep/Vent: One piece, flexible extrusion made from UV resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
   a. Products:
      1) Advanced Building Products Inc.; Mortar Maze weep vent.
      2) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
      3) Heckmann Building Products Inc.; No. 85 Cell Vent.
      4) Hohmann & Barnard, Inc.; Quadro-Vent.
      5) Wire-Bond; Cell Vent.

E. Cavity Drainage Material: Free draining mesh, made from polymer strands that will not degrade within wall cavity.
1. Provide one of the following configurations:
   a. Strips, full depth of cavity and 10 inches wide, with dovetail shaped notches 7 inches deep that prevent mesh from being clogged with mortar droppings.

b. Strips, not less than 2 inches thick and 10 inches wide, with dimpled surface designed to catch mortar droppings and prevent weep holes from being clogged with mortar.

2. Products:
   a. Mortar Net, Mortar Net USA, Ltd.
   b. Mortar Maze, Advanced Building Products.
   c. Architect approved equal.

F. Architect approved equal.

G. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.
   1. Products:
      a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
      b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
      c. Hohmann & Barnard, Inc.; No. RB or No. RB Twin Rebar Positioner.
      d. Wire Bond; “O” Ring or Double “O” Ring Rebar Positioner.
      e. Architect approved equal.

2.11 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Diedrich Technologies, Inc.
      b. EaCo Chem, Inc.
      c. ProSoCo, Inc.
      d. Architect approved equal.

2.12 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Use Portland cement-lime mortar unless otherwise indicated.

B. Pre-blended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a pre-blended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
   1. For reinforced masonry, use Type N.
   2. For interior non-load-bearing partitions, Type O may be used instead of Type N.

D. Grout for Unit Masonry: Comply with ASTM C 476.
   1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

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

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

3.2 INSTALLATION, GENERAL

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

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

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

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

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

F. Mix units from several pallets or cubes as they are placed.

G. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

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

3.3 TOLERANCES

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

B. Lines and Levels:
1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

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

3.4 LAYING MASONRY WALLS

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

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

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

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

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

G. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

H. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
   1. Install compressible filler in joint between top of partition and underside of structure above.
   2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
   3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
   4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 07 Section FIRE-RESISTIVE JOINT SYSTEMS.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:
   1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
   2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
   3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
   4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

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

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

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

3.6 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:
   1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 1.77 sq. ft. of wall area spaced not to exceed 16 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
      a. Where bed joints of wythes do not align, use adjustable (two piece) type ties.
      b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two piece) type ties to allow for differential movement regardless of whether bed joints align.
   2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
      a. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two piece) type reinforcement to allow for differential movement regardless of whether bed joints align.
   3. Header Bonding: Provide masonry unit headers extending not less than 3 inches into each wythe. Space headers not over 12 inches clear horizontally and 16 inches clear vertically.]
   4. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Installing Rigid Cavity Wall Insulation over Metal Stud Back-Up: Shingle Modified Bituminous Membrane Air Barrier over exterior sheathing that is attached to metal studs. Then apply Rigid Cavity Wall Insulation using self-tapping half of Hohmann & Barnard, Inc.; X-Seal Anchor™ or Architect approved equal, secured to metal stud behind Air Barrier, exterior Sheathing, and Insulation.
   1. Secure second half of Anchor to first half and lay triangular portion between mortar joints, as brick veneer is laid up.

3.7 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
   1. Space reinforcement not more than 16 inches o.c.
   2. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using pre-fabricated T-shaped units.

D. Provide continuity at corners by using pre-fabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
   1. Provide an open space not less than 1/2 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
   2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
   3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.9 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing with masonry veneer anchors to comply with the following requirements:
   1. Fasten screw attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
   2. Insert slip in anchors in metal studs as sheathing is installed. Provide one anchor at each stud in each horizontal joint between sheathing boards.
   3. Embed tie sections in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing.
   4. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
   5. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter

3.10 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:
   1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
   2. Install pre-formed control-joint gaskets designed to fit standard sash block.
   3. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

C. Form expansion joints in brick as follows:
   1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
   2. Build flanges of factory-fabricated, expansion-joint units into masonry.
   3. Build in compressible joint fillers where indicated.

4. Form open joint full depth of brick wythe and of width indicated, but not less than 1/2 inch for installation of sealant and backer rod specified in Division 07 Section JOINT SEALANTS.

3.11 LINTELS

A. Install steel lintels where indicated.

B. Provide concrete or masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

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

3.12 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows, unless otherwise indicated:
   1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing.
      a. Install stainless steel drip edge.
      b. Where flashing is within mortar joint, place Thru Wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant or tape as recommended by flashing manufacturer.
   2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and through inner wythe to within 1/2 inch of the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches on interior face.
   3. At masonry veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under building paper or building wrap, lapping at least 4 inches.
   4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
   5. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Division 07 Section JOINT SEALANTS for application indicated.
   6. Install metal drip edges with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Division 07 Section JOINT SEALANTS for application indicated.
   7. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
   8. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
   9. Cut flexible flashing off flush with face of wall after masonry wall construction is completed

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

D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
   1. Use specified weep/vent products to form weep holes.
   2. Space vents 32 inches o.c., unless noted otherwise Locate vents below bottom of Fascia.

E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in PART 2 “Miscellaneous Masonry Accessories”.

F. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.
   1. Close cavities off vertically and horizontally with blocking in manner indicated. Install Thru Wall Flashing and weep holes above horizontal blocking

3.13 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Level 1 special inspections according to the "International Building Code."
   1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
   2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
   3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

E. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

F. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for compressive strength.

G. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.14 REPAIRING, POINTING, AND CLEANING

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

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

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels.
   2. Test cleaning methods on sample wall panel; leave one-half of panel un-cleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
   3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
   4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
   5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.15 MASONRY WASTE DISPOSAL

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

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
   1. Crush masonry waste to less than 4 inches in each dimension.
   2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste.
   3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

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

END OF SECTION 04 2000

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. Structural steel.
2. Miscellaneous steel defined on structural drawings.
3. Grout.

1.3 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.

C. Heavy Sections: Rolled and built-up sections as follows:

1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches (38 mm).
2. Welded built-up members with plates thicker than 2 inches (50 mm).
3. Column base plates thicker than 2 inches (50 mm).

1.4 COORDINATION

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

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

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

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

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.

C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand critical welds.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Welding certificates.

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

D. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.

3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Nonshrink grout.

E. Survey of existing conditions.

F. Source quality-control reports.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.

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

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

1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

D. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.8 DELIVERY, STORAGE, AND HANDLING

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

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

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

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M Grade 50 (345).

B. Channels, Angles: ASTM A 36/A 36M, unless noted otherwise.

C. Plate and Bar: ASTM A 36/A 36M, unless noted otherwise.

D. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade B, structural tubing.

E. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.

1. Weight Class: noted.
2. Finish: Black

F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts

1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.

B. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy-hex steel structural bolts

1. Direct-Tension Indicators: ASTM F 959, Type 490 (ASTM F 959M, Type 10.9), compressible-washer type with plain finish.

C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, [heavy-hex] [round] head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: [Plain] [Mechanically deposited zinc coating].

D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

E. Unheaded Anchor Rods: ASTM F 1554, Grade 36, unless noted otherwise.

1. Configuration: Hooked.
2. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
3. Plate Washers: ASTM A 36/A 36M carbon steel.
4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
5. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

F. Headed Anchor Rods: ASTM F 1554, Grade 55, weldable, unless otherwise noted.

1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
4. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

G. Threaded Rods: ASTM A 36/A 36M

1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
2. Washers: ASTM A 36/A 36M carbon steel.
3. Finish: Plain.

H. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.

I. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.

J. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

2.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

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

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

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

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

C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

F. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.

G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

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

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

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

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.

1. Fill vent and drain holes that will be exposed in the finished Work unless that will function as weep holes, by plugging with zinc solder and filing off smooth.

2.9 **SOURCE QUALITY CONTROL**

A. Testing Agency: Engage a qualified testing agency to perform shop tests and inspections.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Bolted Connections: Inspect and test shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

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

3.2 PREPARATION

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

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

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

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.

2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Bolted Connections: Inspect and test bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.

1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
   a. Liquid Penetrant Inspection: ASTM E 165.
   b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
   c. Ultrasonic Inspection: ASTM E 164.
   d. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

3.6 REPAIRS AND PROTECTION

A. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

B. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

END OF SECTION 051200

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Exterior non-load-bearing wall framing.

B. Related Requirements:
1. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies, with height limitations.
2. Section 092216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

B. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Stud Manufacturers Association.

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Telling Industries

B. Clark-Dietrich

C. MarinoWare

2.2 COLD-FORMED STEEL FRAMING MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade: ST33H (ST230H) for 18ga and lighter, ST50H (ST340H) for 16ga and heavier.
2. Coating: G90 (Z275) or equivalent

B. Steel Sheet for Vertical Deflection and Drift Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: 50 (340), Class 1
2. Coating: G90 (Z275)

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: as defined.
2. Flange Width: as defined.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs
2. Flange Width: 1-1/4 inches (32 mm)

C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

a. Minimum Base-Metal Thickness: 0.0677 inch (1.72 mm)
b. Flange Width: 1 inch (25 mm) plus the design gap for one-story structures

2. Inner Track: Of web depth indicated, and as follows:

a. Minimum Base-Metal Thickness: 0.0677 inch (1.72 mm)
b. Flange Width: sum of outer deflection track flange width plus 1 inch (25 mm)>.

E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.4 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole-reinforcing plates.
11. Backer plates.

2.5 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C

C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 ICC-ES AC193 ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.
2. Type: Torque-controlled expansion anchor
3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5, unless otherwise indicated.
4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts

D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780/A 780M

B. Cement Grout: Portland cement, ASTM C 150/C 150M, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C 1107/C 1107M, and with a fluid consistency and 30-minute working time.

D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.7 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated on Drawings

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to bypassing studs and anchor to building structure.
4. Connect drift clips to cold-formed steel framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches (305 mm) of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at 96-inch (2440-mm) centers

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 ERECTION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.6 FIELD QUALITY CONTROL

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

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 05 5213 - PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted handrails.
B. Stair railings and guardrails.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Placement of anchors in concrete.
B. Section 09 9113 - Exterior Painting: Paint finish.

1.03 REFERENCE STANDARDS

A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2015.
B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.
F. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2009 (Reapproved 2015).
G. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2013.
H. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
I. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014.
J. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
K. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

1.04 SUBMITTALS

A. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   2. Include the design engineer's seal and signature on each sheet of shop drawings.
   3. Copies of Architect’s Drawings, manufacturer’s standard details or other non-project-specific details are not acceptable, and will be returned without review.
   4. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated within the previous 12 months.
   5. Designer's Qualification Statement.
   6. Fabricator's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in NY State, or personnel under direct supervision of such an engineer.
B. Welder Qualifications: Welding processes and welding operators qualified within previous 12 months.
C. Fabricator Qualifications:
   1. A company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

PART 2 PRODUCTS

2.01 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.
B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935
C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935

D. Allow for expansion and contraction of members and building movement without damage to connections or members.

E. Dimensions: See drawings for configurations and heights.

1. Top Rails and Wall Rails: 1-1/2 inches diameter, round.
   a. Intermediate Rails: 1-1/2 inches diameter, round.
   b. Posts: 1-1/2 inches diameter, round.
   c. Pickets:3/4 inch diameter, round.

F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

G. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.02 STEEL RAILING SYSTEM

A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.

B. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

C. Exposed Fasteners: No exposed bolts or screws.

D. Galvanizing: In accordance with requirements of ASTM A123/A123M.

E. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.03 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Welded Joints:

1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Weld connections that cannot be shop welded due to size limitations.

1. Weld in accordance with AWS D1.1/D1.1M.
2. Match shop welding and bolting.
3. Clean welds, bolted connections, and abraded areas.
4. Touch up shop primer and factory-applied finishes.
5. Repair galvanizing with galvanizing repair paint per ASTM A780/A780M.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

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

B. Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Install railings in compliance with ADA Standards for accessible design at applicable locations.

D. Anchor railings securely to structure.

E. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

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

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

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. This Section includes the following:
   1. Framing with Dimension Lumber.
   2. Wood Blocking, Cants, and Nailers.
   3. Wood Furring and Grounds.
   4. Wood Sleepers.
   5. Plywood Backing Panels.

1.3 DEFINITIONS

A. Exposed Framing: Framing not concealed by other construction.

B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
   1. ALSC: American Lumber Standard Committee.
   2. NeLMA: Northeastern Lumber Manufacturers' Association.
   3. NLGA: National Lumber Grades Authority.
   4. SPIB: The Southern Pine Inspection Bureau.

1.4 SUBMITTALS

A. Product Data: For each type of process and factory fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by qualified independent testing agency.
   3. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
   4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

C. Research/Evaluation Reports: For the following, showing compliance with the Building Code of New York State in effect for Project:
   1. Wood Preservative Treated Wood.
   2. Fire Retardant Treated Wood.
   3. Power Driven Fasteners.
   4. Expansion Anchors.
   5. Metal Framing Anchors.

1.5 QUALITY ASSURANCE

A. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Cover stacked lumber laid flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

B. Deliver interior wood materials that are to be exposed to view only after building is enclosed and weatherproof, wet work other than painting is dry, and HVAC system is operating and maintaining temperature and humidity at occupancy levels.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with applicable rules of any rules writing agency certified by ALSC Board of Review. Provide lumber graded by an agency certified by ALSC Board of Review to inspect and grade lumber under rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.

2.2 WOOD PRESERVATIVE TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with ground and continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln dry lumber after treatment to maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings and the following:
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
   3. Wood framing and furring attached directly to the interior of below grade exterior masonry or concrete walls.
   4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
   5. Wood floor plates that are installed over concrete slabs on grade.

2.3 FIRE RETARDANT TREATED MATERIALS

A. General: Comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood).
   1. Use Exterior type for exterior locations and where indicated.
   2. Use Interior Type A, High Temperature (HT) for enclosed roof framing, framing in attic spaces, and where indicated.
   3. Use Interior Type A, unless otherwise indicated.

B. Identify fire retardant treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings, and the following:
   1. Framing for raised platforms.
   2. Concealed blocking.
   3. Roof construction.
   4. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.
   3. Cants.

4. Furring.
5. Grounds.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content and the following species:
   1. Hem Fir (North); NLGA.
   2. Mixed Southern Pine; SPIB.
   3. Spruce Pine Fir; NLGA.

C. For blocking not used for attachment of other construction Utility, Stud or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that interfere with attachment of other work.

E. For furring strips to install plywood or hardboard paneling, select boards with no knots capable of producing bent over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire retardant treated, in 3/4 inch nominal thickness.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
   1. Where rough carpentry is exposed to weather, in ground contact, pressure preservative treated or in area of high relative humidity, provide fasteners with hot dip zinc coating complying with ASTM A 153 of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by qualified independent testing and inspecting agency.
   1. Material: Carbon steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.7 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
   1. Use adhesives that have VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide surface for fastening edges of panels. Space clips not more than 16 inches o.c.

C. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
   1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.

D. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

E. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative treated lumber.
   1. Use inorganic boron for items that are continuously protected from liquid water.
   2. Use copper naphthenate for items not continuously protected from liquid water.

F. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. NES NER-272 for power driven fasteners.
   2. Table 2304.9.1, "Fastening Schedule," in the Building Code of New York State.

G. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

3.2 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1 x 3 inch nominal size furring horizontally and vertically at 24 inches o.c.

C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- size furring vertically at 16 inches o.c.

3.4 PROTECTION

A. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA registered borate treatment. Apply borate solution by spraying to comply with EPA registered label.

END OF SECTION 06 1000

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Elastomeric roofing membrane application.
B. Insulation, flat and tapered.
C. Vapor retarder.
D. Deck sheathing.
E. Cover boards.
F. Flashings.
G. Roofing cant strips, stack boots, roofing expansion joints, and walkway pads.

1.02 RELATED REQUIREMENTS

A. Section 05 3100 - Steel Decking: Placement of acoustical insulation for deck flutes.
B. Section 06 1000 - Rough Carpentry: Wood nailers and curbs.
C. Section 07 0150.19 - Preparation for Re-Roofing.
D. Section 07 6200 - Sheet Metal Flashing and Trim: Counterflashings, reglets and fascia.
E. Section 07 7100 - Roof Specialties: Prefabricated roofing expansion joint flashing.

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).
C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.
D. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.
E. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel; 2007a (Reapproved 2011).
F. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.
G. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a (Reapproved 2013).
H. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2010).
I. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers; 2000 (Reapproved 2012).
J. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact; 2014.
K. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics; 2014.
L. ASTM D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method; 1983 (Reapproved 2012).
M. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2013.
N. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
O. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
P. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2011.
Q. FM (AG) - FM Approval Guide; current edition.
R. ITS (DIR) - Directory of Listed Products; Current Edition.
S. NRCA (WM) - The NRCA Waterproofing Manual; 2005.
T. UL (DIR) - Online Certifications Directory; Current Edition.
U. UL (FRD) - Fire Resistance Directory; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of associated counterflashings installed under other sections.
B. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers; review preparation and installation procedures and coordination and scheduling necessary for related work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.
C. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, and paver layout.
D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
E. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.
F. Manufacturer's qualification statement.
G. Installer's qualification statement.
H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum Ten years of documented experience.
B. Installer Qualifications: Company specializing in performing the work of this section with minimum Five years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.
B. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.
C. Store materials in weather protected environment, clear of ground and moisture.
D. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.
E. Protect foam insulation from direct exposure to sunlight.

1.08 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.
B. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
D. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
B. Correct defective work within a two year period after Date of Substantial Completion.
C. Provide 30 year manufacturer's material and labor warranty to cover failure to prevent penetration of water.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. EPDM Membrane Materials:
   1. Carlisle SynTec Systems; Sure-Tough EPDM: www.carlisle-syntec.com/#sle.
   2. Firestone Building Products; _____: www.firestonebpco.com/#sle.
   3. Johns Manville; JM EPDM: www.jm.com/#sle.
   4. Versico Roofing Systems; VersiGard EPDM: www.versico.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ROOFING - UNBALLASTED APPLICATIONS

A. Elastomeric Membrane Roofing: One ply membrane, fully adhered, over vapor retarder and insulation.

2.03 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

A. Membrane: Ethylene-propylene-diene-monomer (EPDM); externally reinforced with fabric; complying with minimum properties of ASTM D4637/D4637M.
   1. Thickness: 90 mil, 0.090 inch, minimum.
   2. Sheet Width: 76 inches, maximum; factory fabricate into widest possible sheets.
   3. Color: Black.
   4. Tensile Strength: 1600 psi, minimum, measured in accordance with ASTM D412.

5. Ultimate Elongation: 4685 percent, minimum, measured in accordance with ASTM D412.
6. Tear Strength: 200 lbf per inch, measured in accordance with ASTM D624.
7. Water Vapor Permeability: 0.03 perm inch, measured in accordance with ASTM E96/E96M.

B. Seaming Materials: As recommended by membrane manufacturer.

C. Vapor Retarder: self-adhered sheet composite membrane, compatible with roofing and insulation materals., complying with requirements of fire rating classification; compatible with roofing and insulation materials.
1. Fire-retardant adhesive.

D. Flexible Flashing Material: Same material as membrane.
1. Tensile Strength: 1,200 psi.
2. Elasticity: 50 percent with full recovery without set.
3. Color: Black.

2.04 DECK SHEATHING

A. Deck Sheathing: Glass mat faced gypsum panels, ASTM C1177/C1177M, fire resistant type, 1/4 inch thick.
1. Thickness: 1/2 inch, fire-resistant.
2. Products:
a. Georgia-Pacific; DensDeck: www.densdeck.com/#sle.
b. Georgia-Pacific; DensDeck Prime with EONIC Technology: www.densdeck.com/#sle.
c. USG Corporation; Securock Ultralight Glass-Mat Roof Board: www.usg.com/#sle.
d. Substitutions: See Section 01 6000 - Product Requirements.

2.05 COVER BOARDS

A. Cover Boards: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
1. Thickness: 1/2 inch, fire-resistant.
2. Products:
a. Georgia-Pacific; DensDeck Prime Roof Boards with EONIC Technology: www.densdeck.com/#sle.
b. Georgia-Pacific; DensDeck StormX Roof Boards with EONIC Technology: www.densdeck.com/#sle.
c. Substitutions: See Section 01 6000 - Product Requirements.

2.06 INSULATION

A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
1. Classifications:
a. Type II: Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.
1) Class 1 - Faced with glass fiber reinforced cellulosic facers on both major surfaces of the core foam.
2) Compressive Strength: Classes 1-2-3, Grade 1 - 16 psi (110 kPa), minimum.
3) Thermal Resistance, R-value: At 1-1/2 inches thick; Class 1, Grades 1-2-3 - 8.4 (1.48) at 75 degrees F.
2. Board Size: 48 by 48 inches.
3. Board Thickness: 2.0 inch.
4. Tapered Board: Slope as indicated; minimum thickness one (1) inch; fabricate of fewest layers possible.
5. Products:
a. Dow Chemical Company; ____: www.dow.com/#sle.
b. GAF; EnergyGuard Polyiso Insulation: www.gaf.com/#sle.
c. Versico Roofing Systems; SecurShield Insulation: www.versico.com/#sle.
d. Carlisle, Inc: www.carlislesyntec.com/#sle.
1) Basis of Design: Carlisle Syntec "Ins
e. Substitutions: See Section 01 6000 - Product Requirements.

2.07 ACCESSORIES

A. Roofing Expansion Joint Flashing: Sheet butyl.

B. Cant and Edge Strips: Wood fiberboard, compatible with roofing materials ; cants formed to 45 degree angle.

C. Sheathing Adhesive: Noncombustible type, for adhering gypsum sheathing to metal deck.

D. Sheathing Joint Tape: Heat resistant type, 6 inches wide, self adhering.

E. Membrane Adhesive: As recommended by membrane manufacturer.

F. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.

G. Surface Primer Over Roof Substrate for Adhesion of Membrane: Low VOC acrylic primer for application over roofing substrates.
   1. Color: White.
   2. Roof Membrane Substrate: Includes galvanized metal, plywood, concrete, aluminum with Kynar finish, EPDM, EIFS, or _____ as indicated on drawings.

H. Insulation Adhesive: As recommended by insulation manufacturer.

I. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
   1. Product: Roofing System manufacturer's standard.
   2. Size: As indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 PREPARATION - CONCRETE DECK

A. Fill surface honeycomb and variations with latex filler.

B. Do not begin work until elevated concrete substrate has cured at least 28 days and moisture content is five percent or less.
   1. Test as Follows:
      a. Concrete Moisture Content: No beading water under plastic after 16 hours when tested in accordance with ASTM D4263.
      b. Relative Humidity in Concrete: Not greater than 75 percent when tested in accordance with ASTM F2170.

3.03 PREPARATION - METAL DECK

A. Install deck sheathing on metal deck.
   1. Lay with long side at right angle to flutes; stagger end joints; provide support at ends.
   2. Cut sheathing cleanly and accurately at roof breaks and protrusions to provide smooth surface.
   3. Tape joints.

B. Fasten sheathing to roof deck with continuous mopping of adhesive on each flute.

3.04 INSTALLATION - VAPOR RETARDER AND INSULATION, UNDER MEMBRANE

A. Install vapor retarder to deck surface with adhesive in accordance with manufacturer's instructions.
   1. Extend vapor retarder under cant strips and blocking to deck edge.
   2. Install flexible flashing from vapor retarder to air seal material of wall construction, lap and seal to provide continuity of the air barrier plane.

B. Ensure vapor retarder is clean and dry, continuous, and ready for application of insulation.

C. Cover Boards: Mechanically fasten cover boards in accordance with roofing manufacturer's instructions and FM (AG) Factory Mutual requirements.

D. Lay subsequent layers of insulation with joints staggered minimum 6 inches from joints of preceding layer.

E. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.

F. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

G. Do not apply more insulation than can be covered with membrane in same day.

3.05 INSTALLATION - MEMBRANE

A. Install elastomeric membrane roofing system in accordance with manufacturer's recommendations and NRCA (WM) applicable requirements.

B. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

C. Shingle joints on sloped substrate in direction of drainage.

D. Fully Adhered Application: Apply adhesive to substrate at rate of 1.7 gal per 100 sq ft. or as recommended by Roofing System Manufacturer. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll

before proceeding to adjacent rolls.

E. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

F. At intersections with vertical surfaces:

1. Extend membrane over cant strips and up a minimum of 4 inches onto vertical surfaces.
2. Fully adhere flexible flashing over membrane and up to nailing strips.

G. Around roof penetrations, seal flanges and flashings with flexible flashing.

H. Install roofing expansion joints where indicated. Make joints watertight.

I. Coordinate installation of roof drains and sumps and related flashings.

3.06 CLEANING

A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.

B. Remove bituminous markings from finished surfaces.

C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

D. Repair or replace defaced or damaged finishes caused by work of this section.

3.07 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, gutters, and downspouts.

B. Sealants for joints within sheet metal fabrications.

C. Precast concrete splash pads.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood nailers for sheet metal work.

B. Section 07 9200 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.

B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2015.

C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.

D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

F. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

G. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021.

H. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

I. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.

J. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2012.

K. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

L. ASTM D2178/D2178M - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing; 2013a.

M. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free; 2007 (Reapproved 2012).

N. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012).

O. CDA A4050 - Copper in Architecture - Handbook; current edition.

P. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

A. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1. Copies of Architect's Drawings, manufacturer's standard details or other non-project-specific details are not acceptable, and will be returned without review.

B. Samples: Submit two samples 2 by 3 inch in size illustrating metal finish color.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 14 gage, 0.063 inch thick; plain finish shop pre-coated with fluoropolymer coating.

1. Fluoropolymer Coating: High performance organic powder coating, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
2. Color: As selected by Architect from manufacturer's full and custom colors.

B. Stainless Steel: ASTM A666/A666M, Type 304 alloy, soft temper, 28 gauge, 0.0156 inch thick; smooth No. 4 - Brushed finish.

2.02 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
B. Form pieces in longest possible lengths.
C. Hem exposed edges on underside 1/2 inch; miter and seam corners.
D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
E. Tin edges of copper sheet to be soldered; solder shop formed metal joints, and after soldering, remove flux, wipe and wash solder joints clean; provide weathertight joints.
F. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
G. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
H. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

2.03 GUTTER AND DOWNSPOUT FABRICATION

A. Gutters: SMACNA (ASMM) Rectangular profile.
B. Downspouts: Rectangular profile.
C. Gutters and Downspouts: Size for rainfall intensity determined by a storm occurrence of 1 in 10 years in accordance with SMACNA (ASMM).
D. Gutters and Downspouts: Size indicated.
E. Accessories: Profiled to suit gutters and downspouts.
    1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
    2. Gutter Supports: Brackets.
    3. Downspout Supports: Brackets.
F. Splash Pads: Precast concrete type, of size and profiles indicated; minimum 3,000 psi at 28 days, with minimum 5 percent air entrainment.
G. Downspout Extenders: Same material and finish as downspouts.

2.04 ACCESSORIES

A. Fasteners: Stainless steel, with soft neoprene washers.
B. Underlayment: ASTM D2178/D2178M, glass fiber roofing felt.
C. Slip Sheet: Rosin sized building paper.
D. Primer: Zinc chromate type.
E. Protective Backing Paint: Asphaltic mastic, ASTM D4479 Type I.
F. Concealed Sealants: Non-curing butyl sealant.
G. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
H. Fenestration Perimeter Flashing Attachments: Two-piece flashing receiver and clip of extruded aluminum, at least 0.045 inch thick, for attaching flashing at perimeter of exterior wall fenestration openings.
    1. Provide flashing receiver profile appropriate for flashing applications.
I. Plastic Cement: ASTM D4586/D4586M, Type I.
J. Reglets: Surface mounted type, galvanized steel; face and ends covered with plastic tape.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.
B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.
C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

A. Insert flashings into cut reglets to form tight fit; secure in place with stainless steel spring wedges; seal flashings into reglets with sealant.

B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
C. Apply plastic cement compound between metal flashings and felt flashings.
D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
E. Exterior Flashing Receivers: Install in accordance with manufacturer's recommendations, and in proper relationship with adjacent construction, and as follows:
F. Seal metal joints watertight.
G. Set splash pads under downspouts, and set in place with sand.

3.04 SCHEDULE

A. Through-Wall Flashing in Masonry:
   1. Material: Stainless Steel.
B. Gutters and Downspouts:
   1. Material: Pre-fiinshed Aluminum.
   2. Thikcness: 0.63 inch
C. Counterflashings at Curb-Mounted Roof Items:
   1. Material: ASTOM A666 Stainless Steel
   2. Thickness: 22 gauge

END OF SECTION

SECTION 07 8400 - FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems consisting of a material, or combination of materials installed to retain the integrity the fire-resistance rated construction by maintaining an effective barrier against the spread of flame, or smoke, and/or hot gases through penetrations, blank openings, construction joints, or at the gap that is created at the building perimeter of the horizontal fire resistance rated assembly and non-fire-resistance rated exterior wall and in or adjacent to either fire-resistance or non-fire-resistance rated barriers in accordance with the requirements of the Building Code for this project.

B. Firestopping of joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated, including but not limited to the following:

1. Penetrations through fire-resistance-rated wall assemblies including both empty openings and openings that contain penetrations.
2. Membrane penetrations in fire-resistance-rated wall assemblies where items penetrate one side of the barrier.
3. Joints in fire-resistance-rated assemblies that/to allow independent movement.
4. Perimeter of the horizontal fire-resistance rated assembly and exterior wall between a rated floor/roof and an exterior wall assembly that is not fire-resistance rated.

C. Code-Required Special Inspections and Testing.

1.02 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.

B. ASTM E1399 - Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems; 2017.

C. ASTM E3038 - Standard Practice for Assessing and Qualifying Candidates as Inspectors of Firestop Systems and Fire-Resistive Joint Systems.; 2016.

D. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a.

E. ASTM E1966 - Standard Test Method for Fire Resistive Joint Systems; 2007 (Reapproved 2011).

F. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestops; 2014b.

G. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2010a (Reapproved 2015).

H. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2015b.

I. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2013.

J. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

K. IAS AC291 - Accreditation Criteria for Special Inspection Agencies; 2017.

L. ITS (DIR) - Directory of Listed Products; current edition.

M. FM 4991 - Approval Standard for Firestop Contractors; 2013.

N. FM (AG) - FM Approval Guide; current edition.

O. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

P. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

Q. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

R. UL (DIR) - Online Certifications Directory; Current Edition.

S. UL (FRD) - Fire Resistance Directory; current edition.

1.04 PERFORMANCE REQUIREMENTS

A. Penetrations: Provide and install firestopping products that once installed to the tested and listed system or engineering judgment (EJ) / equivalent fire-resistance rated assembly (EFRRA) to become firestop systems or EJ/EFRRA's that are produced to resist the spread of fire, and/or the passage of smoke through breaches, gaps, openings, in fire-resistance-rated and smoke resistant assemblies according to requirements indicated, including but not limited to the following:

1. Firestop all breaches made in fire-resistance rated assemblies for penetrating items passing through fire-resistance-rated wall and floor assemblies and other locations as indicated on the drawings.

2. Provide and install complete penetration firestopping systems that have been tested and approved by a nationally recognized third-party testing agency to the listing and the manufacturers installation instructions.
3. F - Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated, as determined through testing in accordance with ASTM E814 or UL 1479, of not less than the fire-resistance rating of the construction assembly being penetrated by the penetrating item.
4. T - Rated Through-Penetration Firestop Systems: Provide firestop systems with T ratings (temperature), in addition to F ratings, as determined per ASTM E814 or UL 1479, where indicated and/or required by the applicable Building Code.
5. L – Rated Through-Penetration Firestop Systems: Provide firestop systems with L ratings (Air Leakage), in addition to F and T ratings, as determined in accordance with UL 1479, where indicated.
6. W – Rated Through-Penetration Firestop Systems: Provide firestop systems with W ratings (Water Resistance), in addition to F, T and L ratings, as determined in accordance with UL 1479, UL 2079, where indicated.
7. For penetrations involving non-metallic, CPVC, PVC, or plastic piping, tubing or conduit, provide firestop systems that are chemically compatible in accordance with Manufacturer requirements.

B. Perimeter Interior Fire Barrier Systems: Provide perimeter interior fire barrier systems with fire-resistance ratings indicated, as determined per ASTM E2307, but not less than the fire-resistance rating of the floor construction.

C. Fire-Resistive Joints: Provide fire resistive joint systems with fire-resistance ratings indicated, as determined by tests performed to ASTM E1966 and ASTM E1399, ASTM E2837, or UL 2079, but not less than the fire-resistance rating of the assembly in which the breach, void or joint occurs. For where fire resistance rated walls do not meet and create a breach between a non-fire resistant horizontal assembly, provide fire resistive joint systems with fire-resistance ratings as determined by testing performed in accordance with ASTM E2837.

D. For firestopping breaches, gaps or joints exposed to view, traffic, moisture, and physical damage, provide firestop systems that meet conditions expected as communicated through construction documents.

E. Where there is no specific third party tested and listed, classified firestop system available for a particular firestop configuration, the firestopping contractor shall obtain from the firestop manufacturer, an Engineering Judgment (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA) for submittal. All EJ's or EFRRA's shall state that the assembly is expected to pass the appropriate fire test and is equivalent to a tested and listed firestop system.

1.05 SUBMITTALS

A. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number, including fully illustrated system design listing from nationally recognized testing agency for each configuration.
1. Reference system numbers in the UL (FRD), under product categories XHEZ, XHDG or XHBN, as indicated in Part 2.
2. System numbers from other approved agencies shall be acceptable.

B. Shop Drawings: Each Prime Contractor shall provide details, illustrating project specific construction and proposed firestopping related to their portion of work. Where firestopping is required at the intersection of the work of multiple Prime Contractors, the Contractor responsible for the firestopping shall coordinate the proposed detail with the others prior to submitting, and each shall install their respective work accordingly. Details are required at the following locations:
1. Top of loadbearing and non-loadbearing interior partitions where intersecting horizontal construction.
2. Horizontal and vertical MEP penetrations with firestopping components requiring installation within the construction penetrated, e.g. sleeves cast into concrete slabs.
3. Penetrations requiring coordination of multiple Prime Contractors.
4. Abnormally large openings or complex geometries.
5. Any condition for which an EJ or EFRRA is required.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Sustainable Design Submittal: Submit VOC content documentation for nonpreformed materials.

E. Manufacturer's Installation Instructions for each product proposed: Indicate preparation and installation instructions.
1. Include manufacturer's repair procedures

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

G. Manufacturer's qualification statement.

H. Installer Qualification: Submit qualification statements, and proof of Quality Assurance requirements, for installing mechanics.

I. Special Inspection and Field Testing reports: Special Inspector shall submit report as outlined in Field Quality Control in Part 3.

1.06 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Engage an experienced installer who meets all of the following:
   1. Trained and accredited by manufacturer. (Not by supplier or distributor.)
      a. A manufacturer's willingness to sell its firestopping products to a Contractor does not confer qualifications on buyer.
   2. Approved by Factory Mutual Research Corporation under FM 4991, or UL Qualified Firestopping Contractor program.

D. Special Inspection Agency Qualifications: Special Inspection agencies shall be one of the following:
   1. IAS AC291 Accredited for Firestop Systems.
   2. Intertek's Qualified Personnel (IQP) Program.
   3. Approved by Authority Having Jurisdiction (AHJ) in writing, after submitting qualifications per ASTM E3038.

E. Special Inspectors Credentials: Special Inspectors shall have experience in the same type and complexity of work inspected, and shall prove competence by possessing one or more of the following:
   1. FM Firestop Exam. (Passing @ 80%.)
   2. UL Firestop Exam. (Passing @ 80%.)
   3. IFC Firestop Special Inspector Exam.
   4. Approved by Authority Having Jurisdiction (AHJ) in writing, after submitting qualifications per ASTM E3038.

F. Single Source Responsibility: Obtain firestop systems from a single primary firestop systems manufacturer, to the greatest extent possible.
   1. Materials of different manufacture than allowed by the tested and listed system shall not be intermixed in the same firestop system, void, breach, gap, intersection or opening.
   2. Tested and listed, classified firestop systems are to be used. If another manufacturer has a tested and listed system, then that system shall be used in lieu of submitting an Engineering Judgment (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA).

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver firestopping products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacture

B. Store and handle firestopping materials in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Firestopping Product Manufacturers:
   1. 3M Fire Protection Products: www.3m.com/firestop.
   2. Hilti, Inc: www.us.hilti.com/#sle.
   3. Metacaulk, a brand of Rectorseal, LLC: www.metacaulk.com.
   4. Nelson FireStop Products: www.nelsonfirestop.com/#sle.
   5. NUCO, Inc: www.nucoinc.com.
   6. Specified Technologies Inc: www.stifirestop.com/#sle.
   7. Tremco Commercial Sealants & Waterproofing; TREMstop Acrylic: www.tremcosealants.com/#sle.
   8. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.

B. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.

C. Mold and Mildew Resistance: Provide firestoppping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.

D. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

E. Fire Ratings: Refer to drawings for locations of rated assemblies requiring requiring firestopping.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.

1. Movement: Provide systems that have been tested to show movement capability as required.
2. Temperature Rise: Provide systems that have been tested to show T Rating where required.
3. Air Leakage: Provide systems that have been tested to show L Rating where required.
4. Where floor assembly is not required to have a fire rating, provide systems that have been tested to show L Rating as indicated.

B. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.
1. Movement: Provide systems that have been tested to show movement capability as required.

C. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
1. Movement: Provide systems that have been tested to show movement capability as required.
2. Air Leakage: Provide systems that have been tested to show L Rating as required.
3. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

D. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
1. Temperature Rise: Provide systems that have been tested to show T Rating where required.
2. Air Leakage: Provide systems that have been tested to show L Rating as required.
3. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

2.04 FIRESTOPPING FOR FLOOR-TO-FLOOR, FLOOR-TO-WALL, HEAD-OF-WALL, AND WALL-TO-WALL JOINTS

A. Concrete and Concrete Masonry Walls and Floors:
1. Floor to Floor Joints: FF-D-1xxx.
2. Top of Wall Joints at Concrete/Concrete Masonry Wall to Concrete Over Metal Deck Floor: HW-D-xxxx.
3. Top of Wall Joints at Concrete/Concrete Masonry Wall to Concrete Floor: HW-D-xxxx.
4. Concrete/Concrete Masonry Wall to Wall Joint Systems That Have Not Been Tested For Movement Capabilities (Static): WW-S-xxxx.

B. Gypsum Board Walls:
1. Top of Wall Joints at Underside of Flat Concrete: HW-D-xxxx

2.05 FIRESTOPPING FOR FLOOR-TO-WALL MOVABLE JOINTS

A. Floor-To-Wall Joint System That Have Movement Capabilities (Dynamic): FW-D-xxxx

2.06 FIRESTOPPING PENETRATIONS THROUGH CONCRETE AND CONCRETE MASONRY CONSTRUCTION

A. Blank Openings:
1. In Floors or Walls: C-AJ-0xxx.

B. Penetrations Through Floors or Walls By:
1. Multiple Penetrations in Large Openings: C-AJ-8xxx.
2. Uninsulated Metallic Pipe, Conduit, and Tubing: C-AJ-1xxx.
3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing: C-AJ-2xxx.
4. Electrical Cables Not In Conduit: C-AJ-3xxx.
5. Cable Trays with Electrical Cables: C-AJ-4xxx.
6. Electrical Busways: C-AJ-6xxx.
7. Insulated Pipes: C-AJ-5xxx.
8. HVAC Ducts, Uninsulated: C-AJ-7xxx.

C. Penetrations Through Floors By:
1. Multiple Penetrations in Large Openings: F-A-8xxx.
2. Uninsulated Metallic Pipe, Conduit, and Tubing: F-A-1xxx.
3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing: F-A-2xxx.
4. Electrical Cables Not In Conduit: F-A-3xxx.
5. Electrical Busways: F-A-6xxx.
6. Insulated Pipes: F-A-5xxx.

D. Penetrations Through Walls By:
1. Uninsulated Metallic Pipe, Conduit, and Tubing: W-J-1xxx.
2. Electrical Cables Not In Conduit: W-J-3xxx.
3. Insulated Pipes: C-AJ-5xxx.
4. HVAC Ducts, Uninsulated: W-J-7xxx.

5. HVAC Ducts, Insulated: W-J-7xxx.

2.07 FIRESTOPPING PENETRATIONS THROUGH FRAMED FLOORS

A. Metallic Pipe, Conduit, and Tubing Penetrations in Framed Floors: F-C-1xxx.
B. Non-Metallic Pipe, Conduit or Tubing in Framed Floors: F-C-2xxx.
C. Electrical Cable in Framed Floors: F-C-3xxx.
D. Insulated Pipe in Framed Floors: F-C-5xxx

2.08 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS

A. Blank Openings: W-L-0xxx.
B. Penetrations By:
   1. Multiple Penetrations in Large Openings: W-L-8xxx.
   2. Uninsulated Metallic Pipe, Conduit, and Tubing: W-L-1xxx.
   3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing: W-L-2xxx.
   4. Electrical Cables Not In Conduit: W-L-3xxx
   5. Cable Trays with Electrical Cables: W-L-4xxx.
   6. Insulated Pipes: W-L-5xxx.
   7. HVAC Ducts, Insulated: W-L-7xxx.

2.09 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.
   1. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.
   2. Provide systems with W and L ratings as indicated, and as outlined under Performance Criteria in Part 1.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with manufacturers installation requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Notify the responsible party or parties of any unsatisfactory conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.
B. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
B. Remove incompatible materials that could adversely affect bond.
C. Verify that field dimensions are as shown on the Drawings, tested and listed, classified systems, Engineering Judgments, EFRRA's and as recommended by the manufacturer's installation instructions.
D. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION GENERAL

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
B. Do not cover installed firestopping until inspected by Owner's Independent Testing Agency.
C. Install labeling required by code.

3.04 INSTALLATION OF PENETRATION FIRESTOPPING

A. Comply with the Performance Requirements in this section and manufacturer's installation instructions, system design listings and drawings.
   1. Coordinate with other trades to assure that all pipes, conduit, cable, and other items, which penetrate fire-resistance rated construction, have been permanently installed prior to installation of firestop assemblies.
   2. Multiple penetrations require minimum space between penetrating items equal to the size of the smallest penetrating item, but not less than 2 inches.
   3. Schedule the work to assure that partitions and all other construction that conceals penetrations are not erected prior to the installation of firestop and smoke seals.
   4. Schedule the work to assure that field quality control measures may be performed as indicated prior to the installation of materials or construction that may hinder access. Coordinate timing of multi-step installations requiring multiple inspections to avoid unnecessary disassembly of components.
B. Install packing/backing/forming materials and other accessories in accordance with manufacturers installation instructions, tested and listed, classified systems.

C. Install fill, void and cavity materials for through-penetration firestop systems by proven techniques as recommended by the manufacturer, tested and listed, classified system and tooled to produce the following results:
   1. Clean surfaces as recommended by manufacturers' written instructions and the system design listing.
   2. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items, in accordance with the system design listing.
   3. Install materials so they contact and adhere to substrates formed by openings and penetrating items.
   4. Finish to produce smooth, uniform surfaces as recommended by manufacturer's installation instructions and tested and listed, classified system requirements.

3.05 INSTALLATION OF FIRESTOP JOINT SYSTEMS

A. Comply with the Performance Requirements in this section and manufacturer's installation instructions, system design listings and drawings.
   1. Install joint forming materials to provide support of firestop materials during application and at the position required to produce the cross-sectional shapes and depths of installed firestop material relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.

B. Install tested and listed, classified systems and non-tested EJ's, EFRRA's that result in firestop materials:
   1. Directly contacting and fully wetting joint substrates.
   2. Completely filling recesses provided for each joint configuration in accordance with the system design listing,
   3. Providing uniform, cross-sectional shapes and depths relative to joint width that optimize movement capability and meet tested and listed system requirements.

C. Tool or smooth non-sag firestop sealant materials immediately after their application and prior to the time skinning or begins as stated in the manufacturer's installation instructions. Form smooth, uniform beads of configuration indicated or required to:
   1. produce fire-resistance rating.
   2. to eliminate air pockets.
   3. to ensure contact and adhesion with sides of joint.

3.06 INSTALLATION OF PERIMETER FIRE BARRIER SYSTEMS

A. Comply with Performance Requirements in this section and with manufacturer's installation instructions, systems design listings and drawings.

B. Install metal framing, curtain wall insulation, mechanical attachments, safing materials and other firestop system components as applicable within the system design, engineering judgement/equivalent fire-resistance rated assembly.

3.07 FIELD QUALITY CONTROL

A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174, and ASTM E2393, and submit report as indicated in Submittals in Part 1.
   1. Installer shall be responsible for repairing installations disturbed during testing per manufacturer's procedures.

B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.08 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.09 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION {CH#10000874}

SECTION 07 9200 - JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
B. Section 09 3000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

1.03 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2006 (Reapproved 2011).
B. ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants; 2015.
C. ASTM C834 - Standard Specification for Latex Sealants; 2014.
D. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.
E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.
F. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2000 (Reapproved 2011).
G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.
H. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2008 (Reapproved 2012).
I. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2014.
J. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2002 (Reapproved 2013).
K. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2013.
L. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

1.04 SUBMITTALS

A. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.
   5. Substrates for which use of primer is required.
   6. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
   7. Sample product warranty.
B. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
C. Selection Samples: For each finish where color selection is not indicated or proposed material varies from Basis-of-Design, provide two sets of color chips representing proposed manufacturer's full range of available colors.
   1. Where manufacturer specific color is indicated, proposed products of other manufacturers must be available in matching color, or provide custom color to match at no additional cost. Adequacy of color matching is at the sole discretion of the Architect.
   2. Where other non-basis-of-design manufacturers are listed without colors, they may be considered of like quality, but is not meant to imply that those manufacturer's offer adequately matching products for all types required.
D. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.
E. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.
F. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.
G. Field Quality Control Plan: Submit at least two weeks prior to start of installation.
H. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.
I. Field Quality Control Log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

1.05 QUALITY ASSURANCE

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

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

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

D. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.

1. Adhesion Testing: In accordance with ASTM C794.
2. Compatibility Testing: In accordance with ASTM C1087.
3. Allow sufficient time for testing to avoid delaying the work.
4. Deliver to manufacturer sufficient samples for testing.
5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
6. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.

E. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.

1. Identification of testing agency.
2. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
   a. Test date.
   b. Copy of test method documents.
   c. Age of sealant upon date of testing.
   d. Test results, modeled after the sample form in the test method document.
   e. Indicate use of photographic record of test.

F. Field Quality Control Plan:

1. Visual inspection of entire length of sealant joints.
2. Non-destructive field adhesion testing of sealant joints, except interior acrylic latex sealants.
   a. For each different sealant and substrate combination, allow for one test every 12 inches in the first 10 linear feet of joint and one test every 24 inches thereafter.
   b. If any failures occur in the first 10 linear feet, continue testing at 12 inches intervals at no extra cost to Owner.
3. Destructive field adhesion testing of sealant joints, except interior acrylic latex sealant.
   a. For each different sealant and substrate combination, allow for one test every 100 feet in the first 1000 linear feet, and one test per 1000 linear feet thereafter, or once per floor on each elevation.
   b. If any failures occur in the first 1000 linear feet, continue testing at frequency of one test per 500 linear feet at no extra cost to Owner.
4. Field testing agency's qualifications.
5. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.

G. Field Adhesion Test Procedures:

1. Allow sealants to fully cure as recommended by manufacturer before testing.
2. Have a copy of the test method document available during tests.
3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
4. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
5. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
6. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.

H. Non-Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Nondestructive Spot Method.

1. Repair failed portions of joints.

I. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.

1. Sample: At least 18 inches long.
2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch by that percentage; if adhesion failure occurs before the "1 inch mark" is that distance from the substrate, the test has failed.

3. If either adhesive or cohesive failure occurs prior to minimum elongation, take necessary measures to correct conditions and re-test; record each modification to products or installation procedures.

1.06 WARRANTY

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

B. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
1. ADFAST Corporation: www.adfastcorp.com/#sle.
2. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
3. Pecora Corporation: www.pecora.com/#sle.
4. Sika Corporation: www.usa-sika.com/#sle.
5. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
1. ADFAST Corporation: www.adfastcorp.com/#sle.
2. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
3. Pecora Corporation: www.pecora.com/#sle.
4. Sika Corporation: www.usa-sika.com/#sle.
5. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 JOINT SEALANTS - GENERAL

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

B. Where changes in finished surface or color warrant a change in sealant color to maintain design intent, provide multiple colors required, and install as indicated in PART 3 below.

C. Sealants appplied for bedding of door/window sills, "internal" joints in wall or floor construction, or other locations concealed by finished work need not be of any specific color. Manufacturer's "transition runs", overruns, or other such off-color products may be used at these locations so long as manufacturer certifies products meet specified perfomance requiremements.

2.03 NONSAG JOINT SEALANTS

A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
4. Color: To be selected by Architect from manufacturer's full range.

B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
1. Color: White.

C. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single-component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Architect from manufacturer's full range.

D. Non-Sag "Traffic-Grade" Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 40 to 50, Shore A, when tested in accordance with ASTM C661.

E. Acrylic-Urethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; paintable; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 12-1/2 percent, minimum.
2. Hardness Range: 15 to 40, Shore A, when tested in accordance with ASTM C661.

F. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.

G. Non-Curing Butyl Sealant: Solvent-based, single component, non-sag, non-skinning, non-hardening, non-bleeding; non-vapor-permeable; intended for fully concealed applications.

2.04 SELF-LEVELING SEALANTS

A. Self-Leveling Silicone Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent, explicitly approved by manufacturer for traffic exposure when recessed below traffic surface; not expected to withstand continuous water immersion.
   1. Movement Capability: Plus 100 percent, minus 50 percent, minimum.
   2. Color: To be selected by Architect from manufacturer's standard range.
   3. Manufacturers:
      a. ADFAST Corporation; ADSEAL LM 4600 SL Series: www.adfastcorp.com/#sle. (Basis-of-Design)
      b. Dow; DOWSIL SL Parking Structure Sealant: www.dow.com/#sle.
      c. Pecora Corporation; Pecora 300 SL (Self-Leveling): www.pecora.com/#sle.
      d. Sika Corporation; Sikasil 728SL: www.usa.sika.com/#sle.
      e. Tremco Commercial Sealants & Waterproofing; Spectrem 900SL: www.tremcosealants.com/#sle.
      f. Substitutions: See Section 01 6000 - Product Requirements.

B. Self-Leveling Polyurethane Sealant for Horizontal Expansion Joints: ASTM C920, Grade P, Uses T, M, and O; multi-component; explicitly approved by manufacturer for horizontal expansion joints.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Hardness Range: 30 to 35, Shore A, when tested in accordance with ASTM C661.

2.05 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
   1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
   2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
   3. Open Cell: 40 to 50 percent larger in diameter than joint width.
   4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.

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

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

D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.

E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
   1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
   2. Notify Architect of date and time that tests will be performed, at least seven days in advance.
   3. Record each test on Preinstallation Adhesion Test Log as indicated.
   4. If any sample fails, review products and installation procedures, consult manufacturer, or take whatever other measures are necessary to ensure adhesion; re-test in a different location; if unable to obtain satisfactory adhesion, report to Architect.
   5. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.

3.02 PREPARATION

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

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
   1. Prime surfaces and fully dry/cure prior to installation of backing.

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

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

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
B. Perform installation in accordance with ASTM C1193.
C. Perform acoustical sealant application work in accordance with ASTM C919.
D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
E. Install bond breaker backing tape where backer rod cannot be used.
F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
I. Multiple color joints: Where joint requires more than one color of sealant, apply first color slightly beyond transition points, tool joint, and allow initial cure. Cut back end of sealant to transition point, clean residue from surfaces, and apply next sealant color.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.
B. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.
C. Non-Destructive Adhesion Testing: If there are any failures in first 100 linear feet, notify Architect immediately.
D. Destructive Adhesion Testing: If there are any failures in first 1000 linear feet, notify Architect immediately.
E. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.
F. Repair destructive test location damage immediately after evaluation and recording of results.

3.05 POST-OCCUPANCY

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

END OF SECTION

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PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Standard and custom hollow metal frames.
   2. Steel sidelight, borrowed lite and transom frames.

B. Related Sections:
   1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
   2. Division 08 Section “Flush Wood Doors”.
   3. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
   4. Division 08 Section "Door Hardware".
   5. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
   1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
   2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
   3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
   4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
   5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
   6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
   9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
   10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
   11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
   12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
   13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
   14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
   15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
   16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.

B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.

C. Shop Drawings: Include the following:
   1. Elevations of each door design.
   2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of anchorages, joints, field splices, and connections.
   6. Details of accessories.
   7. Details of moldings, removable stops, and glazing.
   8. Details of conduit and preparations for power, signal, and control systems.

D. Samples for Verification:
   1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40" above sill) or UL 10C.
   1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
   2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
   3. Smoke Control Door Assemblies: Comply with NFPA 105.
      a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.

E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
   1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.07 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
   1. CECO Door Products (C).
   2. Curries Company (CU).
   3. Steelcraft (S).

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic

C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.03 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A1008M.
   1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
   2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
   3. Frames: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
   4. Manufacturers Basis of Design:
      a. Curries Company (CU) - CM Series.
      b. Curries Company (CU) - M Series.

C. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.04 FRAME ANCHORS

A. Jamb Anchors:
   1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
   2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.05 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.

D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Custom color required to match existing conditions.

2.06 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.07 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Frames:
   1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
      a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
   3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
   4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
   5. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.

6. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
7. Electrical Knock Out Boxes: Factory weld 18 gauge electrical knock out boxes to frame for electrical hardware preps; including but not limited to, electric through wire transfer hardware, electrical raceways and wiring harnesses, door position switches, electric strikes, magnetic locks, and jamb mounted card readers as specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware".
   a. Provide electrical knock out boxes with a dual 1/2-inch and 3/4-inch knockouts.
   b. Conduit to be coordinated and installed in the field (Division 26) from middle hinge box and strike box to door position box.
   c. Electrical knock out boxes to comply with NFPA requirements and fit electrical door hardware as specified in hardware sets in Division 08 Section "Door Hardware".
   d. Electrical knock out boxes for continuous hinges should be located in the center of the vertical dimension on the hinge jamb.
8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
9. Jamb Anchors: Provide number and spacing of anchors as follows:
   a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      1) Two anchors per jamb up to 60 inches high.
      2) Three anchors per jamb from 60 to 90 inches high.
      3) Four anchors per jamb from 90 to 120 inches high.
      4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
   b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      1) Three anchors per jamb up to 60 inches high.
      2) Four anchors per jamb from 60 to 90 inches high.
      3) Five anchors per jamb from 90 to 96 inches high.
      4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
      5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".

D. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
   1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
   2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
   3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
   4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.10 STEEL FINISHES

A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

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

3.02 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.04 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION 08 1113

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
1. Solid core doors with wood veneer faces.
2. Factory finishing wood doors.
3. Factory fitting wood doors to frames and factory machining for hardware.
4. Louvers installed in flush wood doors.
5. Light frames and glazing installed in wood doors.

B. Related Sections:
1. Division 08 Section "Hollow Metal Doors and Frames".
2. Division 08 Section "Glazing".
3. Division 08 Section "Door Hardware".

C. Standards and References: Comply with the version year adopted by the Authority Having Jurisdiction.
1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ANSI A208.1 – Wood Particleboard.
3. Intertek Testing Service (ITS Warnock Hersey) - Certification Listings for Fire Doors.
4. NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
5. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
6. UL 10C - Positive Pressure Fire Tests of Door Assemblies; UL 1784 - Standard for Air Leakage Tests of Door Assemblies.
7. Window and Door Manufacturers Association - WDMA I.S.1-A Architectural Wood Flush Doors.

1.03 SUBMITTALS

A. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, trim for openings, and WDMA I.S.1-A classifications. Include factory finishing specifications.

B. Shop Drawings shall include:
1. Indicate location, size, and hand of each door.
2. Indicate dimensions and locations of mortises and holes for hardware.
3. Indicate dimensions and locations of cutouts.
4. Indicate requirements for veneer matching.
5. Indicate location and extent of hardware blocking.
6. Indicate construction details not covered in Product Data.
7. Indicate doors to be factory finished and finish requirements.
8. Indicate fire protection ratings for fire rated doors.

C. Samples for Initial Selection: For factory finished doors.
1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
2. Corner sections of doors, 8 by 10 inches, with door faces and edges representing actual materials to be used.
   a. Provide samples for each species of veneer and core material.
   b. Finish veneer faced door samples with same materials proposed for factory finished doors.
3. Frames for light openings, 6 inches long, for each material, type, and finish required.

D. Warranty: Provide sample of manufacturer’s warranty.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, latest edition, "Industry Standard for Architectural Wood Flush Doors’.

C. Fire Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing at positive pressure according to NFPA 252 (neutral pressure at 40" above sill) or UL10C.
   1. Oversize Fire Rated Door Assemblies: For units exceeding sizes of tested assemblies provide manufacturer's construction label, indicating compliance to independent 3rd party certification agency's procedure, except for size.
   2. Temperature Rise Limit: Where required and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire test exposure.
   3. Smoke Control Door Assemblies: Comply with NFPA 105.
   4. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

D. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for receiving, handling, and installing flush wood doors.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package pre-finished doors individually in plastic bags and wrap bundles of doors in plastic sheeting.

C. Mark each door on top rail with opening number used on Shop Drawings.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.07 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
      b. Telegraphing of core construction in wood face veneers exceeding 0.01 inch in a 3-inch span.
   2. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.
   3. Warranty Period for Solid Core Interior Doors: Life of installation.

PART 2 PRODUCTS

2.01 DOOR CONSTRUCTION – GENERAL

A. WDMA I.S.1-A Performance Grade: Extra Heavy Duty; Aesthetic Grade: Premium.

B. Fire Rated Doors: Provide construction and core as needed to provide fire ratings indicated.
   1. Category A Edge Construction: Provide fire rated door edge construction with intumescent seals concealed by outer stile (Category A) at 45, 60, and 90 minute rated doors. Comply with specified requirements for exposed edges.
   2. Pairs: Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
      a. Provide fire retardant stiles that are listed and labeled for applications indicated without formed steel edges and astragals.
      b. Where required for concealed hardware, provide formed steel edges and astragals with intumescent seals. Finish steel edges and astragals with baked enamel.

2.02 CORE CONSTRUCTION

A. Structural Composite Lumber Core Doors:
   1. Structural Composite Lumber: Engineered hardwood composite wood products tested in accordance with WDMA I.S.1A, Testing Cellulosic Composite Materials for Use in Fenestration Products containing no added Urea Formaldehyde.

B. Fire Resistant Composite Core Doors:
   1. Core: Non-combustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire protection rating indicated.
   2. Blocking: As indicated under article "Blocking".
   3. Edge Construction: At hinge stiles, provide laminated edge construction with improved screw holding capability and split resistance. Comply with specified requirements for exposed edges.

C. Sound Resistant Doors:

1. Provide 1-3/4" thick sound resistant doors complying with the Sound Transmission Class (STC) ratings as prescribed in the latest version of ASTM Standard E-90. Doors are to be furnished complete with gaskets and other acoustical accessories required for specified STC rating. Consult manufacturer details for gasketing, automatic door seals, thresholds, and other hardware or special frames which may be required.
2. Blocking: As indicated under article “Blocking”.
3. Provide sound resistant doors with minimum STC sound rating as indicated.

2.03 BLOCKING

A. Non-Fire-Rated Doors:
1. Provide blocking as indicated below:
a. HB1: 5 inch in doors indicated to have closers and overhead stops.
b. HB4: Two 5 inch x 14 inch lock blocking, in doors indicated to have exit devices.
c. HB5: Two 5 inch x 14 inch corner blocking, in doors indicated to have flush bolts.
d. HB6: 5 inch mid-rail blocking in doors indicated to have exit devices.

B. Fire Rated Doors:
1. Provide blocking as indicated below:
a. HB1: 5 inch in doors indicated to have closers and overhead stops.
b. HB4: Two 5 inch x 14 inch lock blocking in doors indicated to have exit devices.
c. HB5: Two 5 inch x 14 inch corner blocking in doors indicated to have flush bolts.
d. HB6: 5 inch mid-rail blocking in doors indicated to have exit devices.

2.04 VENEERED DOORS FOR TRANSPARENT FINISH

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ASSA ABLOY Wood Doors (GR): GPD Series.
2. Eggers Industries (EG): Premium Series.
3. Marshfield-Algoma (MF): Signature Series.
4. VT Industries (VT): Artistry Series.

B. Interior Solid Core Doors:
1. Grade: Premium.
2. Faces: Veneer grades as noted below; veneer minimum 1/50-inch (0.5mm) thickness at moisture content of 12% or less.
a. Match Existing Species and Cut, A grade faces.
3. Match between Veneer Leaves: Book match.
4. Assembly of Veneer Leaves on Door Faces:
a. Center Balance Match.
5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
6. Transom Match: Continuous match.
7. Vertical Edges: Matching same species as faces. Wood or composite material, one piece, laminated, or veneered. Minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors.
8. Horizontal Edges: Solid wood or structural composite material meeting the minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors
9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit sanded before applying face veneers.
10. At doors over 40% of the face cut-out for lights and or louvers, furnish engineered composite lumber core.

2.05 LIGHT FRAMES AND GLAZING

A. Metal Frames: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated.
1. Manufacturers:
a. Air Louver (LV).
b. All Metal Stamping (AP).
c. Anemostat (AN).
d. Pemko (PE).

B. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with the flush wood door manufacturer's written instructions

C. Finish: Custom color to match door veneer. (match existing conditions)

2.06 FABRICATION

A. Factory fit doors to suit frame opening sizes indicated.
1. Comply with requirements in NFPA 80 for fire rated doors.

2. Undercut: As required per manufacturer's templates and sill condition.

B. Factory machine doors for hardware that is not surface applied. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Factory machine astragals and formed steel edges for hardware for pairs of fire rated doors.

C. Openings: Cut and trim openings through doors in factory.
1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Comply with applicable requirements in Division 08 Section "Glazing."
3. Louvers: Factory install louvers in prepared openings.

D. Electrical Raceways: Provide flush wood doors receiving electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through wire transfer hardware or wiring harness specified in hardware sets in Division 08 "Door Hardware". Wire nut connections are not acceptable.

2.07 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Transparent Finish: Provide a clear protective coating over the wood veneer allowing the natural color and grain of the selected wood species to provide the appearance specified. Stain is applied to the wood surface underneath the transparent finish to add color and design flexibility.
1. Finish: Meet or exceed WDMA I.S. 1A TR8 UV Cured Acrylated Polyester finish performance requirements.
2. Staining:
a. Custom stain to match architect's sample.
3. Sheen: Satin.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine doors and installed door frames before hanging doors.
1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

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

3.02 INSTALLATION

A. Hardware: For installation, see Division 8 Section "Door Hardware."

B. Installation Instructions: Install doors and frames to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
1. Install fire rated doors in corresponding fire rated frames according to NFPA 80.

C. Factory Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

E. Field modifications to doors shall not be permitted, except those specifically allowed by manufacturer or fire rating requirements.

3.03 ADJUSTING

A. Operation: Re-hang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 1416

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire-rated coiling counter doors with integral sill, and operating hardware.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Rough openings.

B. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

C. Section 08 7100 - Door Hardware: Cylinder cores and keys.

D. Section 09 2116 - Gypsum Board Assemblies: Rough openings.

E. Division 05 1200 – Structural Steel Framing for miscellaneous steel support.

F. Division 26 Sections for electrical service and connections for powered operators and accessories.

G. Division 28 Sections for Fire alarm interconnection.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

C. ITS (DIR) - Directory of Listed Products; current edition.

D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

E. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design overhead colining doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's standard literature showing materials and details of construction and finish. Include data on electrical operation.

C. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Show locations of replaceable fusible links.
   3. Copies of Architect’s Drawings, manufacturer’s standard details or other non-project-specific details are not acceptable, and will be returned without review.

D. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-aplied finishes.

E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Curtain Slats: 12 inches long.
   2. Bottom Bar: 6 inches long with sensor edge.
   3. Guides: 6 inches long.
   4. Brackets: 6 inches square.
   5. Hood: 6 inches square.

F. Delegated-Design Submittal: For overhead coiling doors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of seismic restraints.
2. Summary of forces and loads on walls and jambs.

G. Manufacturer's Instructions: Indicate installation sequence and installation, adjustment, and alignment procedures.

H. Operation and Maintenance Data: Indicate modes of operation, lubrication requirements and frequency, and periodic adjustments required.

I. Project Record Documents: Include as-built electrical diagrams for electrical operation and connection to fire alarm system.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance in units required for this Project.

B. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
1. Obtain operators and controls from overhead coiling door manufacturer.

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to UL 10B.
1. Smoke Control: In corridors and smoke barriers, provide doors that are listed and labeled with the letter "S" on the fire-rating label by a qualified testing agency for smoke- and draft-control based on testing according to UL 1784; with maximum air-leakage rate of 3.0 cfm/sq. ft. of door opening at 0.10 inch wg for both ambient and elevated temperature tests.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Regulatroy Requirements: Comply with applicable provisions in ICC/ANSI A177.1.

F. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

1.07 WARRANTY

A. Standard Warranty: Two years from date of substantial completion against defects in material and workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Coiling Integral Counter Fire Doors:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Cornell Iron Works, Inc.; Model: ERC11 (Smokeshield) or comparable product by one of the following:
2. Alpine Overhead Doors, Inc: www.alpinedoors.com.
3. Wayne-Dalton, a Division of Overhead Door Corporation: www.wayne-dalton.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Coiling Counter Doors, Fire-Rated w/ integral countertop: Stainless steel slat curtain.
1. Mounting: Face of wall
2. Provide integral sill of same material and finish.
3. Operation Cycles: Not less than 10,000
   a. Include tamperproof cycle counter.
4. Fire Rating: As indicated on the drawings with smoke control; comply with NFPA 80.
   a. Provide product listed and labeled by ITS (DIR) or UL (DIR) as suitable for the purpose specified and indicated.
5. Nominal Slat Size: 1-1/2 inches wide.
6. Slat Profile: Flat.
7. Finish: No. 4 - Brushed.
8. Guides: Formed track; stainless steel, no.4 finish.
9. Integral Countertop : Stainless Steel; No. 4 finish
   a. Provide "T" shape.
   b. Size as shown on drawings.
10. Hood Enclosure: Stainless Steel; No. 4 finish.
11. Coiling Door Release Mechanism: Fire alarm system activated with automatically governed closing speed.
12. Motor Operation:
    a. AlarmGard Advanced Tube Motor Operation:
       1. AlarmGard Series Electric Tube Motor: UL, cUL listed NEMA 1 enclosure, [115v/ 60 Hz/ single phase service] [230v/ 50 Hz/ single phase service]. Provide a totally enclosed non ventilated motor, removable without affecting the setting of limit switches; thermal overload protection, planetary gear reduction, adjustable rotary limit switch mechanism and a transformer

with 24v secondary output. All internal electrical components are to be prewired to terminal blocks.3548

i. Provide a failsafe tubular motor operated fire shutter assembly requiring no ancillary or externally mounted release devices, cables, chains, pulleys, reset handles or mechanisms
ii. Provide an internal electrical failsafe release device that requires no additional wiring, external cables or mounting locations
iii. Provide an internal solenoid brake mechanism to hold the door at any position during normal door operation
iv. Control automatic closure speed with an internal, totally enclosed, variable rate centrifugal governor without the use of electrical pulsation, constant rate viscosity, oscillation type or other exposed governing devices
v. Electrically activate door system automatic closure by [notification from central alarm system] [notification from local detectors] or [power outage] [power outage exceeding 6 hours with controller mounted battery backup system].
vi. Maintain automatic closure speed at not more than 12" (229 mm) per second.
vii. Enable safety edge function during alarm gravity closing while power is present. Enable door to rest upon obstruction following this sequence.
viii. Electrically reset internal failsafe release device and door operating system upon restoration of electrical power and upon clearing of the alarm signal without requiring human supervision
ix. Provide selectable ability for the door system to automatically self-cycle to the fully open position following automatic reset without requiring human supervision
x. Ensure that manual resetting of spring tension, release devices, linkages or mechanical dropouts will not be required
xi. Notify electrical contractor to mount control station(s) and supply the appropriate disconnect switch, all conduit and wiring per the door system wiring instructions
xii. Drop test and reset door system twice by all means of activation and comply fully with NFPA 80 Section 5.

2.02 MATERIALS

A. Curtain Construction: Interlocking, single thickness slats.
1. Slat Ends: Not less than Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
2. Curtain Bottom: Fitted with tube to provide reinforcement and positive contact in closed position; vinyl astragal along bottom edge. Material and finish to match curtain.
3. Steel Slats: ASTM A653/A653M galvanized steel sheet, with minimum G90/Z275 coating; minimum thickness 22 gage, 0.03 inch.
4. Stainless Steel Slats: ASTM A666, Type 304; minimum thickness 22 gage, 0.03 inch.

B. Guide Construction: Continuous, of profile to retain door in place, with mounting brackets of same metal.
1. Guides for Galvanized Curtains: Two piece clear anodized extruded aluminum in clear anodized finish with polypropylene pile runners. Side rail assemblies bolt to the wall and support the entire weight of the unit.
2. Stainless Steel Guides: ASTM A666, Type 304, rollable temper.
3. Provide removable stops on guides to prevent overtravel of curtain.
a. Removable Posts and Jamb Guides for Counter Doors: Manufacturer's standard.

C. Hood Enclosure: Internally reinforced to maintain rigidity and shape. Provide minimum 1/4 inch steel intermediate support brackets as required to prevent excessive sag. Ceiling Recessed
1. Stainless Steel for fire rated curtain: 24 Gauge stainless-steel, ASTM A666, Type 304.
a. Include automatic drop baffle on fire-rated doors to guard against passage of smoke or flame.
2. Galvanized steel for non-fire rated curtain: 24 Gauge galvanized steel, ASTM A653.

D. Lock Hardware:
1. Cylindrical Locking Mechanism: Latchset lock cylinder. operable from both sides, specified in Section 08 7100.
a. Keyed to building keying sytem.
b. Keys: Provide two for each cylinder.

E. Roller Shaft Counterbalance: Steel pipe and torsion steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb nominal force to operate.

F. Curtain Accessories:
1. Smoke Seals: Equip each fire-rated door with smoke-seal perimeter gaskets for smoke and draft control as required for door listing and labeling by a qualified testing agency.
2. Automatic-Closing Device for Fire-Rated Doors: Equip each fire-rated door with an automatic-closing device that is inoperative during normal door operations and that has a governor unit complying with NFPA 80 and as easily tested and rest release mechanism designed to be activated by the folloiwng:
a. Building fire-detection and alarm systems and manufacturer's standard door-holder-release devices.
b. Resetting of spring tension or mechanical dropouts shall not be required.

2.03 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

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.

2.04 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
   1. Run grain of directional finishes with long dimension of each piece.
   2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
   3. Directional Satin Finish: No. 4.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that opening sizes, tolerances and conditions are acceptable.

3.02 INSTALLATION

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

B. Install fire-rated doors in accordance with NFPA 80 and NFPA 105 for smoke and draft control..

C. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

D. Securely and rigidly brace components suspended from structure.

E. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

F. Complete wiring from fire alarm system with Division 28 .

3.03 TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.

B. Maximum Variation From Plumb: 1/16 inch.

C. Maximum Variation From Level: 1/16 inch.

D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft straight edge.

3.04 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Perform installation and startup checks according to manufacturer's written instruction.
   2. Test and adjust controls and safeties. Replace damaged adn malfunctioning controls and equipment.
   3. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.05 ADJUSTING

A. Adjust hardware and moving parts to function smoothly and noiseless so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide weathertight fit around entire perimeter.

3.06 DEMOSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

3.07 CLEANING

A. Clean installed components.

B. Remove labels and visible markings.

END OF SECTION 08 3313

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. Horizontal-sliding, transaction security windows.

1.3 COORDINATION

A. Coordinate installation of anchorages for security windows. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in adjacent construction. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for window units.

B. Shop Drawings: For security windows.
   1. Include plans, elevations, sections, and attachments to other work.
   2. Full-size section details of framing members, including internal armoring, reinforcement, and stiffeners.
   3. Hardware for sliding window units.
   4. Glazing details.
   5. Details of deal tray, speak hole, and transaction counter.

C. Samples for Initial Selection: For frame members with factory-applied color finishes.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Test Reports: For each type of security window and accessory indicated as ballistics or forced-entry resistant, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

D. Examination reports documenting inspections of substrates, areas, and conditions.

E. Anchor inspection reports documenting inspections of built-in and cast-in anchors.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: All primary products specified in this section shall be supplied by a single manufacturer, with a minimum of ten (10) years' experience.

B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation of units required for this Project.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Pack security windows in wood crates for shipment. Crate glazing separate from frames unless factory glazed.

B. Label security window packaging with drawing designation.

C. Store crated security windows on raised blocks to prevent moisture damage.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.9 SEQUENCING

A. Field Painting: Except where security windows have been pre-glazed before installation, complete field painting of security windows before glazing installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace security windows that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including deflections exceeding 1/4 inch.
      b. Failure of welds.
      c. Faulty operation of sliding window hardware.
      d. Faulty operation of transaction drawers.
      e. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
   2. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS (As Scheduled)

2.1 PERFORMANCE REQUIREMENTS

A. Attack Resistance: Provide units identical to those tested for compliance with requirements indicated, and as follows:
   1. Ballistics Resistance: Level 3 when tested according to UL 752 “Standard for Bullet Resisting Equipment”.
   2. Forced-Entry Resistance: Class II when tested according to ASTM F 1233, “Test Method for Security Glazing Materials and Systems”.

2.2 SLIDING, TRANSACTION SECURITY WINDOWS

A. Provide horizontal-sliding, transaction security windows. (
   1. Basis-of-Design Product: Subject to compliance with requirements, provide “Bullet Resistant Transaction Window - Horizontal Slider” by Total Security Solutions, Inc., or comparable product by one of the following:
      a. Action Bullet Resistant Corp.
      b. Armortex.
      c. C. R. Laurence Architectural Products.
      d. Ready Access.
      e. United States Bullet Proofing, Inc.
      f. Architect approved equal.

B. Configuration: One fixed-glazed panel and one horizontal-sliding glazed panel**.**
   1. Size: Custom sizes, as shown on drawings.

C. Framing: Fabricate perimeter framing, mullions, and glazing stops from aluminum, as follows:
   1. Profile: Manufacturer's standard.
   2. Depth: Manufacturer's standard.

D. Glazing Meeting Edges: Polished glazing.

E. Sliding Window Hardware: Provide roller track designed for overhead support of two- or four-wheel carriage supporting horizontal-sliding glazed panel. Provide manufacturer's standard pull and lock with two keys for each horizontal-sliding glazed panel.

F. Glazing and Glazing Materials: Impact resistant, glass-clad polycarbonate glazing, type and thickness as required to meet Performance Requirements listed above.

G. Speaking Portal shall be clear acrylic.

H. Materials:
1. Mild Steel Plates, Shapes, and Bars: ASTM A 36.
2. Cold-Rolled Steel Sheet: ASTM A 1008, CS (Commercial Steel), Type B; suitable for exposed applications.
3. Metallic-Coated Steel Sheet: ASTM A 653, CS (Commercial Steel), Type B; with G60 zinc (galvanized) or A60 zinc-iron-alloy (galvannealed) coating designation.
4. Hot-Rolled Steel Sheet: ASTM A 1011, CS (Commercial Steel), Type B; free of scale, pitting, or surface defects; pickled and oiled.
5. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666 or ASTM A 240, austenitic stainless steel, Type 304.
6. Aluminum Extrusions: ASTM B 221. Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength.
7. Aluminum Sheet and Plate: ASTM B 209.

2.3 FABRICATION

A. General: Fabricate security windows to provide a complete system for assembly of components and anchorage of window units.
1. Provide units that are re-glazable from the secure side without dismantling the non-secure side of framing.
2. Prepare security windows for glazing unless pre-glazing at the factory is indicated.

B. Framing: Miter or cope corners the full depth of framing; weld and dress smooth.
1. Fabricate framing with manufacturer's standard, internal opaque armoring in thicknesses required for security windows to comply with ballistics-resistance performance indicated.

C. Glazing Stops: Finish glazing stops to match security window framing.

D. Welding: Weld components to comply with referenced AWS standard. To greatest extent possible, weld before finishing and in concealed locations to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

E. Metal Protection: Separate dissimilar metals to protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.

F. Pre-glazed Fabrication: Pre-glaze window units at factory, where required for applications indicated.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. 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.

2.5 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
1. Color and Gloss: As selected by Architect from manufacturer's full range of standard and custom options.

2.6 ACCESSORIES (All Security Windows)

A. Bullet Trap Recessed Currency Deal Trays: Formed from stainless steel; fabricated in curved shape with exposed flanges for recessed installation into horizontal surface.
1. Clear Opening Size: 12 inches wide by 8 inches deep by 1-1/2 inches high.

B. Concealed Bolts: ASTM A 307, Grade A unless otherwise indicated.

C. Cast-in-Place Anchors in Concrete: Fabricated from corrosion-resistant materials capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified testing agency; of type indicated below.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 27 cast steel or ASTM A 47 malleable iron. Provide bolts, washers, and shims as required; hot-dip galvanized according to ASTM A 153 or ASTM F 2329.

D. Embedded Plate Anchors: Fabricated from mild steel shapes and plates, minimum 3/16 inch thick; with minimum 1/2-inch- diameter, headed studs welded to back of plate.

E. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

F. Miscellaneous Glazing Materials: Provide material, size, and shape complying with requirements of glass manufacturers and with a proven record of compatibility with surfaces contacted in installation.
1. Cleaners, Primers, and Sealers: Type recommended by sealant or gasket manufacturer.
2. Setting Blocks: Elastomeric material with a Type A Shore durometer hardness of 85, plus or minus 5.
3. Spacers: Elastomeric blocks or continuous extrusions with a Type A Shore durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
4. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

G. Anchors, Clips, and Window Accessories: Stainless steel; hot-dip, zinc-coated steel or iron, complying with ASTM B 633; provide sufficient strength to withstand design pressures indicated.

H. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

I. Sealants: For sealants required within fabricated security windows, provide type recommended by manufacturer for joint size and movement. Sealant shall remain permanently elastic, non-shrinking, and non-migrating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of security windows.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations of security window connections before security window installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of security windows.

D. Inspect built-in and cast-in anchor installations, before installing security windows, to verify that anchor installations comply with requirements. Prepare inspection reports.
1. Remove and replace anchors where inspections indicate that they do not comply with specified requirements. Re-inspect after repairs or replacements are made.
2. Perform additional inspections to determine compliance of replaced or additional work. Prepare anchor inspection reports.

E. For glazing materials whose orientation is critical for performance, verify installation orientation.

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

3.2 PREPARATION

A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other security window anchors whose installation is specified in other Sections.
1. Furnish cast-in-place anchors and similar devices to other trades for installation well in advance of time needed for coordinating other work.

3.3 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing security windows to in-place construction. Include threaded fasteners for inserts, security fasteners, and other connectors.

B. Removable Glazing Stops and Trim: Fasten components with security fasteners.

C. Fasteners: Install security windows using fasteners recommended by manufacturer with head style appropriate for installation requirements, strength, and finish of adjacent materials. Provide stainless-steel fasteners in stainless-steel materials.

D. Sealants: Comply with requirements in Division 07 Section JOINT SEALANTS for installing sealants, fillers, and gaskets.

E. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended in writing by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

3.4 FIELD QUALITY CONTROL

A. Inspect installed products to verify compliance with requirements. Prepare inspection reports and indicate compliance with and deviations from the Contract Documents.

B. Perform additional inspections to determine compliance of replaced or additional work. Prepare inspection reports.

C. Prepare field quality-control certification that states installed products and their installation comply with requirements in the Contract Documents.

3.5 ADJUSTING

A. Adjust horizontal-sliding, transaction security windows to provide a tight fit at contact points for smooth operation and a secure enclosure.

B. Remove and replace defective work, including security windows that are warped, bowed, or otherwise unacceptable.

3.6 CLEANING AND PROTECTION

A. Clean surfaces promptly after installation of security windows. Take care to avoid damaging the finish. Remove excess glazing and sealant compounds, dirt, and other substances.
   1. Lubricate sliding security window hardware.

B. Clean glass of security windows promptly after installation.

C. Provide temporary protection to ensure that security windows are without damage at time of Substantial Completion.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain operable security windows.

END OF SECTION 08 5653

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Commercial door hardware for the following swinging doors:
      a. Flush wood.

1.3 SUBMITTALS

A. Number of Submittals: All items listed in this section are to be included in one submittal prepared by one Supplier.

B. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Samples: Provide samples of products intended to be provided as directed by Architect. Samples will be returned to Contractor.

D. Qualification Data:
   1. Hardware Supplier
      a. Established contract hardware firm which maintains and operates an office, display, and stock in project area and which is a factory authorized distributor of the lock being furnished.
      b. Hardware scheduled and furnished by or under direct supervision an Architectural Hardware Consultant.
      c. All schedules submitted to the Architect for approval and job use must carry the signature and certified seal of this Architectural Hardware Consultant.
   2. Architectural Hardware Consultant
      a. Currently certified by the Door and Hardware Institute.
      b. Full-time employee of the Hardware Supplier or an individual having no contractual ties to any supplier/manufacturer entity.
      c. Available at reasonable times to Architect, Owner, and Contractor during course of work.

E. Maintenance Data: For each type of door hardware. Include final hardware schedule, product datasheets, keying schedule, riser diagrams, and point-to-point wiring diagrams in 3-ring binder, labeled on spine with project name and “Door Hardware”.

F. Warranty: Special warranty specified in this Section.

G. Other Action Submittals:
   1. Door Hardware Sets: Prepared by or under the supervision of a DHI certified Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
      a. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule"; other formats will be rejected without review. Double space entries, and number and date each page.
      b. Numerical Sequence of Sets and Headings: Submittal headings shall be in exact order as hardware sets in specification: one heading only per set. Submittal set numbers shall relate to specification set numbers, ie. if three headings are required for Set 12 due to door width differences, then the heading numbers should be 12.1, 12.2, and 12.3 or employing similar linking logic.
      c. Door Numbers: Identical to those used in the contract documents.
      d. Number of Copies: (5).
      e. Content: Include the following information:
         1) Identification number, location, hand, fire rating, and material of each door and frame.
         2) Type, style, function, size, quantity, and finish of each door hardware item.
         3) Complete designations of every item required for each door or opening including name and manufacturer.
         4) Degree of opening for closer and overhead stop and holder installation.
         5) Keying information.

6) Fastenings and other pertinent information.
7) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
8) Explanation of abbreviations, symbols, and codes contained in schedule.
9) Mounting locations for door hardware.
10) Notes included with specification hardware sets transcribed verbatim into submittal hardware sets.
11) Door and frame sizes and materials.
12) List of related door devices specified in other Sections for each door and frame.

f. Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.

2. Keying Schedule: Prepared by or under the supervision of Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

1.4 QUALITY ASSURANCE

A. Furnish proper hardware types and quantities for door function, hardware mounting and clearances, and to meet applicable codes. Bring discrepancies to the attention of the Architect a minimum of (10) days prior to bid date so that an addendum may be issued. No additional compensation will be allowed after bidding for hardware changes required for proper function, hardware mounting or clearances, or to meet codes.

B. Source Limitations: All items listed in hardware sets are to be furnished by one supplier. Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.
1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

C. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the model building code including, but not limited to, the following:
1. NFPA 70 "National Electrical Code", including electrical components, devices, and accessories listed and labeled as defined in Article 100 by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1 as follows:
a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
b. Door Closers: Comply with the following maximum opening-force requirements indicated:
1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.
3. NFPA 101: Comply with the following for means of egress doors:
a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
b. Thresholds: Not more than 1/2 inch high.
4. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 (neutral pressure at 40" above sill) or UL-10C.
a. Test Pressure: Positive pressure labeling.

D. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to Owner by registered mail or overnight package service. Obtain Owner's contact name and address from Architect.

1.6 COORDINATION

A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Distribute templates in a timely manner so as not to delay suppliers. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
   1. Structural failures including excessive deflection, cracking, or breakage.
   2. Faulty operation of the hardware.
   3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   4. Electrical component defects and failures within the systems operation.

C. Retain or edit Warranty period subparagraphs as applicable to Project.

D. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

E. Special Warranty Periods:
   1. Five years for cylindrical locks and latches.
   2. Five years for exit hardware.
   3. Ten years for manual door closers.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, provide (6) months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.
   1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.

B. Designations: Requirements for design, grade, function, material, finish, size and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:
   1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.

2. References to BHMA Standards: In addition to other requirements in this section, provide products complying with or exceeding these standards and requirements for description, quality, and function.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electrified access control door hardware, in compliance with specifications, must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01 "Substitution Procedures". Approval of requests is at the discretion of the architect, owner, and their designated consultants.

D. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include manufacturers specified.

2.2 BUTT HINGES, GENERAL

A. Quantity: Provide the following, unless otherwise indicated:
1. Two Hinges: For doors with heights up to 60 inches (1524 mm).
2. Three Hinges: For doors with heights 61 to 90 inches (1549 to 2286 mm).
3. Four Hinges: For doors with heights 91 to 120 inches (2311 to 3048 mm).
4. For doors with heights more than 120 inches (3048 mm), provide 4 hinges, plus 1 hinge for every 30 inches (750 mm) of door height greater than 120 inches (3048 mm).

B. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

C. Hinge Height, Width, and Weight: Unless otherwise indicated, provide the following:
1. Doors with Exit Devices or 3'6" or more in width: 5" high, heavy-weight hinges.
2. Doors less than 3'6" in width: 4-1/2" high, standard-weight hinges.
3. Width: 4-1/2" heavy-weight, 4" standard-weight, unless proper clearance requires a different width.
4. Doors with Closers: Antifriction-bearing hinges.

D. Hinge Base Metal: Unless otherwise indicated, provide the following:
1. Exterior and in-swinging restroom door hinges: Stainless steel, with stainless-steel pin.
2. Balance of hinges: Steel, with steel pin.

E. Hinge Options: Provide the following:
1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for reverse bevel lockable doors.
2. Corners: Square.
3. Number of knuckles: Three.

F. Fasteners: Comply with the following:
1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
2. Wood Screws: For wood doors and frames.
3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
4. Screws: Phillips flat-head. Finish screw heads to match surface of hinges.

G. Template Hinge Dimensions: BHMA A156.7.

H. Available Manufacturers:
1. Hager Companies (HAG).
2. McKinney Products Company; an ASSA ABLOY Group company (MCK).
3. Stanley Commercial Hardware; Div. of The Stanley Works (STH).
4. PBB, Inc. (PBB)

2.3 LOCKS AND LATCHES, GENERAL

A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).

B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

C. Lock Trim:
1. Levers: Cast.
   a. Match existing lockset levers.
2. Roses: Forged.
3. Lockset Designs: Provide design indicated in hardware sets, or, if sets are provided by another manufacturer, provide designs that match those designated.

D. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
1. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.

E. Backset: 2-3/4 inches (70 mm), unless otherwise indicated.

F. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:
1. Strikes for Mortise Locks and Latches: BHMA A156.13.

2.4 MECHANICAL LOCKS AND LATCHES

A. Lock Types: Provide mortise or bored locks as indicated by model number in the Hardware Schedule.

B. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:
1. Mortise Locks: BHMA A156.13.

C. Mortise Locks: Stamped steel case with steel or brass parts; BHMA A156.13 Grade 1.
1. Available Manufacturers:
   a. Best Access Systems; Div. of The Stanley Works (BES).
   b. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (COR).
   c. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SAR).
   d. Schlage Commercial Lock Division; an Allegion Company (SCH).

D. Compatibility with Key Cylinders: fully warranted for use with key cylinder furnished.

2.5 EXIT DEVICES

A. Exit Devices: BHMA A156.3, Grade 1.

B. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."
1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).

C. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

E. Fasteners. Manufacturer’s standard.

F. Shims: Provide shims if needed for clearance.

G. Available Manufacturers:

1. Detex, Inc. (DTX)
2. Precision Hardware, Inc. (PH).
3. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SAR).
4. Von Duprin; an Allegion Company (VON).
5. Corbin-Russwin.

2.6 KEY CYLINDERS

A. Standard Lock Cylinders: BHMA A156.5, Grade 1.

B. Cylinders: Provide cylinders for all devices requiring key cylinders to properly function: constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:
   1. Number of Pins: Six or directed by Owner.
   2. Keyway: Patented or non-patented as directed by Owner.
   3. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
   4. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
   5. Match to building's existing system.

C. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
   1. Small-format Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.

D. Construction Keying: Comply with the following:
   1. Construction Cores: Provide construction cores that are replaceable by permanent cores for locking devices on exterior doors plus (4) extra. Provide 6 construction master keys.
      a. Replace construction cores with permanent cores as directed by Owner.

E. Supplemental Items: Provide cylinder spacers, collars, and correct cams as needed for proper function of locking devices.

F. Available Manufacturers:
   1. Best Access Systems; Div. of The Stanley Works (BES).
   2. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (COR).
   3. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SAR).
   4. Schlage Commercial Lock Division; an Allegion Company (SCH).

2.7 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference, and as follows:
   1. Existing system. **BEST**

B. Keys: Nickel silver.
   1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
      a. Notation: "DO NOT DUPLICATE."
   2. Quantity: Provide the following:
      a. Cylinder Change Keys: Three per cylinder.
      b. Master Keys: Six per master.
      c. Grand Master Keys: Six.
      d. Great-Grand Master Keys: Five.
      e. Control Keys: Two.
      f. Construction Control Keys: Two.

2.8 SURFACE CLOSERS

A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."
   1. Comply with the following maximum opening-force requirements:
      a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
      b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.

C. Fasteners: Manufacturer's standard for arms, shoes and brackets.

D. Mounting Accessories: Provide shoes, brackets, drop plates, spacers, etc., as needed for proper mounting of closers and arms to door and frame.
   1. At openings with hollow metal or wood doors in hollow metal frames requiring jamb seals and parallel arm closers, provide 1/4" high or 7/8" high closer arm bracket spacers per the frame stop width for the installation of the critical fifth screw for the arm bracket to the top jamb.
      a. Spacers: 1/4" or 7/8" H, 0.625" OD, 0.281" ID countersunk 0.06", deburred outside edges, grooved (0.032"W x 0.032" D) at 1/8" increments for field cutting, solid 6061 aluminum.
      b. Basis of Design: Cohni Manufacturing (COH), Elyria, OH (ph: 234-206-1540, www.cohni.com), Screw Spacer Combo Pack (has both 1/4" H and 7/8" H models included), Model S-62-CP-25S.

E. Spring Size of Units: Provide field-sizable closers, adjustable for spring sizes 1-6, plus 50% extra spring power at spring size 6, to meet field conditions and requirements for opening force.

F. Cylinders: 1-1/2" minimum diameter; cast iron or high-silicon alloy aluminum.

G. Mounting Configuration: Unless otherwise indicated by model number in the hardware sets:
   1. Do not furnish closers capable of being mounted on the corridor side of doors.
   2. If tri-pack closers are furnished for regular arm applications, remove parallel arm shoe from closer box before delivering to job.

H. Available Manufacturers and Series for Rack and Pinion Surface Closers:
   1. LCN Closers; an Allegion Company (LCN).
   2. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SAR).
   3. Stanley Commercial Hardware; Div. of The Stanley Works (STH).
   4. Corbin-Russwin.

2.9 PROTECTIVE TRIM UNITS

A. Size:
   1. Width
      a. Singles, and pairs with removable mullions or surface applied astragals: 2 inches (38 mm) less than door width on push side and 1 inch (13 mm) less than door width on pull side
      b. Other pairs: 1 inch (13 mm) less than door width
   2. Height: as specified in door hardware sets; or, if constrained by door bottom rail height, 1" less bottom rail height.

B. Fasteners: Manufacturer's machine or self-tapping countersunk screws.

C. Metal Protective Trim Units: BHMA A156.6; beveled 4 sides; fabricated from 0.050-inch- (1.3-mm-) thick stainless steel.

D. Available Manufacturers:
   1. Hager Companies (HAG).
   2. IVES Hardware; an Allegion Company (IVE).
   3. Rockwood Manufacturing Company (ROC).
   4. Trimco (TRI).

2.10 MECHANICAL WALL AND FLOOR STOPS AND HOLDERS

A. Stops and Bumpers: BHMA A156.16, Grade 1.
   1. Provide wall stops for doors unless floor, overhead, or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Provide floor stops (and spacers if needed) of proper height and configuration to accommodate floor condition. Where floor or wall stops are not appropriate, provide overhead holders.
   2. Properties. Cast construction with fastener suitable for wall or floor condition.
   3. Available Manufacturers:
      a. Hager Companies (HAG).
      b. IVES Hardware; an Allegion Company (IVE).

c. Hiawatha (HIW).
d. Burns (BRN).
e. Rockwood Manufacturing Company (ROC).
f. Trimco (TRI).

2.11 SILENCERS

A. Provide silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch (13 mm); fabricated for drilled-in application to frame.

B. Available Manufacturers:
1. Glynn-Johnson; an Allegion Company (GLY).
2. Hager Companies (HAG).
3. IVES Hardware; an Allegion Company (IVE).
4. McKinney Products Company; an ASSA ABLOY Group company (MCK).
5. Rockwood Manufacturing Company (ROC).
6. Trimco (TRI).

2.12 DOOR GASKETING

A. General: Provide continuous weather-strip gasketing on exterior hollow metal doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners as indicated by models in hardware sets.
1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame. If hardware is to be attached to the frame and would interfere with the gasketing, then provide hardware compatible gasketing that does not need to be cut for the mounting of hardware.
2. Seals integral to threshold at out-swinging exterior hollow metal doors.

B. Air Leakage: Not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.

C. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

D. Jamb Gasketing Materials:
1. Adhesive Seals. As specified in hardware sets or approved equal.
2. Screwed-on weatherstrip and sweeps. Neoprene.
3. Panic type thresholds. Neoprene.

E. Available Manufacturers for Jamb Gaskets (provided they provide items with neoprene inserts):
1. Hager Companies (HAG).
2. National Guard Products (NGP).
3. Legacy Manufacturing (LEG).

2.13 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

C. Fasteners: Manufacturer’s standard, except as noted in product sections of this specification.

2.14 FINISHES

A. Standard: BHMA A156.18, as indicated in door hardware sets.

1. **MATCH EXISTING HARDWARE FINISHES. STANDARD SATIN STAINLESS FINISHES MAY BE LISTED IN THE SCHEDULE BELOW. GC TO CONFIRM PRIOR TO ORDERING.**

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

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

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 Series.
   1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.

B. Wood Doors: Comply with DHI A115-W Series.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.
   1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
   2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
   3. Pulls: locate pulls as directed by Architect.

B. Mounting Locations:
   1. Floor Stops and Holders: Locate at least 20" out from hinge edge of door for maximum degree of opening before door encounters obstruction.
   2. Wall Stops: Locate so that lockset spindle and wall stop share horizontal and vertical centerlines.
   3. Closers and Overhead Stop/Holders: Template and mount closers and overhead stops for maximum degree of opening before door encounters obstruction or so as to interface with specified wall stops and holders. When used with closers, template and locate overhead stops so that closer arm does not fully extend and bottom out. These functionality requirements override any degree of opening information in the specifications or submittals.

C. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

B. Door Closers:
   1. Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.
   2. Adjust latch period so that door does not slam nor injure fingers.
   3. Adjust spring power so that door properly latches.
   4. Adjust backcheck to slow door down before hitting stop point so as to prevent damage to closer, arm, door, frame, and fasteners.

C. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 DOOR HARDWARE SCHEDULE

Hardware Set 01

(3)	Butt Hinges	BB1279 4.5 X 4.0	652	HAG
(1)	Storeroom Lock	93K7D	626	BES
(1)	Permanent Cylinder Core		626	BES
(1)	Closer, Regular Arm	4040XP Reg	689	LCN
(1)	Kick Plate	KO050 8 x 2LDW x CS x B4E	630	TRI
(1)	Wall Stop, Convex	1270CX	626	TRI
(1)	Adjustable Jamb Seal Set	107NA	628	NGP
(1)	Surface Sound Sweep	SSDB3	628	DHS

Hardware Set 01A

(3)	Butt Hinges	BB1279 4.5 X 4.0	652	HAG
(1)	Storeroom Lock	93K7D	626	BES
(1)	Permanent Cylinder Core		626	BES
(1)	Closer, Regular Arm	4040XP Reg	689	LCN
(1)	Kick Plate	KO050 8 x 2LDW x CS x B4E	630	TRI
(1)	Wall Stop, Convex	1270CX	626	TRI
(1)	Cat H Jamb Seal Set	135NA	628	NGP

Hardware Set 02

Frame, door, and hardware to remain. See Architect's note on door schedule for door refinishing instructions.

Hardware Set 03

(6)	Butt Hinges	BB1168 5 X 4.5	652	HAG
(1)	FR Key Removable Mullion	KR-9954	689	VON
(1)	Fire Exit Device, Rim, 01	99EO-F x 996EO	630	VON
(1)	Fire Exit Device, Rim, 08	99L-F x 996L	630	VON
(1)	Rim Cylinder		626	BES
(1)	Mortise Cylinder		626	BES
(2)	Permanent Cylinder Core		626	BES
(2)	Closer, HD Parallel Arm	4040XP EDA	689	LCN
(2)	Kick Plate	KO050 8 x 2LDW x CS x B4E	630	TRI
(2)	Wall Stop, Convex	1270CX	626	TRI
(1)	Adjustable Jamb Seal Set	107NA	628	NGP
(2)	Surface Sound Sweep	SSDB3	628	DHS

Hardware Set 04

(3)	Butt Hinges	BB1279 4.5 X 4.0	652	HAG
(1)	Classroom Lock	93K7R	626	BES
(1)	Permanent Cylinder Core		626	BES
(1)	Kick Plate	KO050 8 x 2LDW x CS x B4E	630	TRI
(1)	Wall Stop, Convex	1270CX	626	TRI
(1)	Adjustable Jamb Seal Set	107NA	628	NGP
(1)	Surface Sound Sweep	SSDB3	628	DHS

Hardware Set 04A

(3)	Butt Hinges	BB1279 4.5 X 4.0	652	HAG
(1)	Classroom Lock	93K7R	626	BES
(1)	Permanent Cylinder Core		626	BES
(1)	Kick Plate	KO050 8 x 2LDW x CS x B4E	630	TRI
(1)	Wall Stop, Convex	1270CX	626	TRI

END OF SECTION 08 7100

SECTION 08 8000 - GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glazing units.
B. Plastic sheet glazing units.
C. Plastic films.
D. Laminated glass interlayers.
E. Glazing compounds.

1.02 RELATED REQUIREMENTS

A. Section 08 1213 - Hollow Metal Frames: Glazed borrowed lites.
B. Section 08 1416 - Flush Wood Doors: Glazed lites in doors.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.
B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.
C. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.
D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2011).
E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.
F. ASTM C1036 - Standard Specification for Flat Glass; 2011.
G. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
H. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2024.
I. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.
J. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2015.
K. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting; 2012.
L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
M. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2012a.
N. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.
O. ASTM F3038 - Standard Test Method for Timed Evaluation of Forced-Entry-Resistant Systems; 2014.
P. FTD-SA - FILTI Testing and Development Standard for Shooter Attack Resistance; 2019.
Q. GANA (GM) - GANA Glazing Manual; 2022.
R. GANA (LGRM) - Laminated Glazing Reference Manual; 2009.
S. GANA (SM) - GANA Sealant Manual; 2008.
T. ICC (IBC) - International Building Code; 2015.
U. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2004).
V. ITS (DIR) - Directory of Listed Products; current edition.
W. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2014.
X. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014.
Y. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2014.
Z. UL (DIR) - Online Certifications Directory; Current Edition.
AA. UL 972 - Standard for Burglary Resisting Glazing Material; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data on Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

B. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
C. Samples: Submit one sample, 6 by 6 inch in size.
   1. Provide samples only for non-standard finishes; tinted, obscure, etched, fritted, etc.
D. Manufacturer's qualification statement.
E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods.
B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years of documented experience.
C. Installer Qualifications: Company specializing in performing work of the type specified and with at least ten years documented experience.

1.06 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.
B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

A. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.
B. Laminated Glass: Provide a ten (10) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.
C. Warranty period begins on date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glass Fabricators:
   1. GGI - General Glass International: www.generalglass.com/#sle.
   2. McGrory Glass: www.mcgrory.com.
   3. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com/#sle.
   4. Viracon, Inc: www.viracon.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.
B. Float Glass Manufacturers:
   1. AGC Glass North America, Inc: www.agcglass.com/#sle.
   2. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
   3. Guardian Glass, LLC: www.guardianglass.com/#sle.
   4. Pilkington North America Inc: www.pilkington.com/na/#sle.
   5. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
   6. Substitutions: See Section 01 6000 - Product Requirements.
C. Laminated Glass Manufacturers:
   1. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
   2. Guardian Glass, LLC: www.guardianglass.com/#sle.
   3. McGrory Glass: www.mcgrory.com.
   4. Viracon, Architectural Glass segment of Apogee Enterprises, Inc: www.viracon.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.
D. Fire-Resistance-Rated Glass: Provide products as required to achieve indicated fire-rating period.
   1. Fabricators:
      a. GGI - General Glass International: www.generalglass.com/#sle.
   2. Manufacturers:
      a. SAFTIFIRST, a division of O'Keeffe's Inc: www.safti.com/#sle.
      b. Technical Glass Products: www.fireglass.com/#sle.
      c. Vetrotech North America: www.vetrotechusa.com/#sle.

E. Fire-Protection-Rated Glass: Provide products as required to achieve indicated fire-rating period.
   1. Manufacturers:
      a. SAFTIFIRST, a division of O'Keeffe's Inc: www.safti.com/#sle.
      b. SCHOTT North America Inc: www.us.schott.com/#sle.
      c. Technical Glass Products: www.fireglass.com/#sle.
      d. Vetrotech North America: www.vetrotechusa.com/#sle.

F. Breach Resistant Laminated Security Glass Manufacturers:
   1. LTI Smart Glass, Inc.; School Guard Glass SG-4: www.schoolguardglass.com
   2. Substitutions: Refer to Section 01 6000 - Product Requirements.

2.02 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
   2. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
   3. Impact Resistant Safety Glass: Where required by applicable Code shall Comply with ANSI Z97.1 - Class A, or 16 CFR 1201 - Category II criteria.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
   1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class A or 16 CFR 1201 - Category II impact test requirements.
      a. Polyvinyl Butyral (PVB) Interlayer: 0.030 inch thick, minimum.

C. Breach Resistant Laminated Security Glass: Fully tempered laminated security glass with factory applied security film layer(s).
   1. Burglary Resistance: Pass UL 972.
   2. Shooter Attack Resistance: Pass FTD-SA.
   3. Manufacturers:
      a. Substitutions: Refer to Section 01 6000 - Product Requirements.

2.03 GLAZING UNITS

A. Type M-1 - Monolithic Interior Vision Glazing:
   1. Applications: Interior glazing unless otherwise indicated.
   2. Glass Type: Fully tempered float glass.
   3. Tint: Clear.
   4. Thickness: 1/4 inch, nominal.
   5. Glazing Method: Dry glazing method, gasket glazing.

B. Type FPG-xxx - Fire-Protection-Rated Glazing: Type, thickness, and configuration that contains flame and smoke, but does not block radiant heat, as required to achieve fire-rating period of 45 minutes or less.
   1. Glazing Method: As required for breach resistance and fire ratings.
   2. Markings for Fire-Protection-Rated Glazing Assemblies: Provide permanent markings on fire-protection-rated glazing in compliance with {\rs\#1}, local building code, and authorities having jurisdiction
      a. "xxx" - placeholder that represents fire-rating period, in minutes.
   3. Manufacturers:
      a. SAFTIFIRST, a division of O'Keeffe's Inc; SuperLite X-20/45/60: www.safti.com/#sle.
      b. Vetrotech North America; Keralite L (Select): www.vetrotechusa.com/#sle.
      c. Substitutions: Refer to Section 01 6000 - Product Requirements.

C. Type FPG-S-xxx - Fire-Protection-Rated Breach Resistant Security Glazing: Type, thickness, and configuration meeting breach resistance requirements, and that contains flame, smoke, and does not block radiant heat, as required to achieve fire-rating period of 90 minutes or less.
   1. Applications:
      a. Glazing in fire-rated door assembly.
      b. Glazing in fire-rated window assembly.
      c. Other locations as indicated on drawings.
   2. Provide products listed by ITS (DIR) or UL (DIR) and approved by authorities having jurisdiction.
   3. Safety Glazing Certification: 16 CFR 1201 Category II.
   4. Glazing Method: As required for breach resistance and fire ratings.
   5. Fire-Rating Period: As indicated on drawings.
   6. Markings for Fire-Protection-Rated Glazing Assemblies: Provide permanent markings on fire-protection-rated glazing in compliance with ICC (IBC), local building code, and authorities having jurisdiction.

a. "D" - meets fire door assembly criteria of NFPA 252, UL 10B, or UL 10C fire test standards.
b. "OH" - meets fire window assembly criteria including hose stream test of NFPA 257, or UL 9 fire test standards.
c. "H" - meets fire door assembly hose stream test of NFPA 252, UL 10B, or UL 10C fire tests standards.
d. "xxx" - placeholder that represents fire-rating period, in minutes.

7. Manufacturers:
   a. Armoured One, LLC; AOTSG1016FR: www.armouredone.com
   b. Substitutions: Refer to Section 01 6000 - Product Requirements.

2.04 PLASTIC FILMS

A. Type F1 - Breach Resistant Security Film.
   1. Application: Locations as indicated on drawings.
   2. Surface Burning Characteristics: Flame Spread Index (FSI)/Smoke Developed Index (SDI) of Class A, 25/450, maximum, when tested in accordance with ASTM E84.
   3. Tensile Strength: Minimum of 32,000 psi when measured in accordance with ASTM D882.
   4. Impact Resistance: Comply with ANSI Z97.1 and 16 CFR 1201 impact test requirements when applied to 1/8 inch thick annealed glass.
   5. Shooter Attack Resistance: Pass FTD-SA.
   6. Burglary Resistance: Pass UL 972.
   7. Color: Clear.
   8. Installed Thickness: 0.023 inch.
   9. Anchoring System: Install per menufacturer's recommendations.
      a. Provide supplemental anchoring system as required by manufacturer to meet performance requirements.
   10. Manufacturers:
      a. Armoured One, LLC; AOTSF23 :www.armouredone.com
      b. SchoolGard
      c. Substitutions: Refer to Section 01 6000 - Product Requirements.

2.05 GLAZING COMPOUNDS

A. Butyl Sealant: Single component; ASTM C920 Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.
B. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.
C. Manufacturers:
   1. ADFAST Corporation: www.adfastcorp.com/#sle.
   2. Dow Corning Corporation: www.dowcorning.com/construction.
   3. Pecora Corporation: www.pecora.com.
   4. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.06 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.
B. Spacer Shims: Silicone, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.
C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.
E. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
B. Verify that the minimum required face and edge clearances are being provided.
C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

D. Verify that sealing between joints of glass framing members has been completed effectively.
E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.
B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - PLASTIC FILM

A. Install plastic film with adhesive, applied in accordance with film manufacturer's instructions.
B. Place without air bubbles, creases or visible distortion.
C. Install film tight to perimeter of glass and carefully trim film with razor sharp knife. Provide 1/16 inch to 1/8 inch gap at perimeter of glazed panel unless otherwise required. Do not score the glass.

3.06 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.
B. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.
C. Monitor and report installation procedures and unacceptable conditions.

3.07 CLEANING

A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.
B. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
C. Remove nonpermanent labels immediately after glazing installation is complete.
D. Clean glass and adjacent surfaces after sealants are fully cured.
E. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.08 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION {CH#10006430}

SECTION 09 0561 - COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
   1. Resilient tile and sheet.
   2. Cementitious and Resinous Terrazzo.
   3. Cementitious Cast Underlayment
B. Removal of existing floor coverings.
C. Preparation of existing concrete floor slabs for installation of floor coverings.
D. Testing of concrete floor slabs for moisture and alkalinity (pH) during construction.
E. Mitigation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
   1. Contractor shall perform specified mitigation of concrete floor slabs as indicated by existing conditions. If such mitigation is indicated by results of testing agency's report and is due to a condition not under Contractor's control and could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.
F. Mitigation of concrete floor slabs after removal of flooring or adhesives, including abatement of asbestos containing materials, by mechancial or chemical methods of abatement.
G. Cementitious Cast Underlayment Products: Liquid-Applied, Self-Leveling Floor Underlayment; for areas of slab depressions requiring fill.
   1. Note: Gymspum-Based Underlayment products will not be accepted.
H. Preparation Products.
   1. Patching Compounds.
   2. Self-leveling Compounds.
   3. Ramping Compounds.
I. Mitigation Products.
   1. Moisture Mitigation Coatings.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Additional requirements relating to testing agencies and testing.
B. Section 01 7419 - Construction Waste Management and Disposal: Handling of existing floor coverings removed.
C. Section 09 3000 - Tiling
D. Section 09 6500 - Resilient Flooring, Base, and Accessories
E. Section 09 6623 - Resinous Matrix Terrazzo Flooring

1.03 PRICE AND PAYMENT PROCEDURES

A. Not Used.

1.04 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
B. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2013.
C. ASTM C348 - Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars; 2014.
D. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2012.
E. ASTM D4259 - Standard Practice for Abrading Concrete; 1988 (Reapproved 2012).
F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
G. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
H. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2011.
I. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2011.
J. ASTM F3010 - Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings; 2018.

K. ASTM F3513 - Standard Practice for Single Component, Fluid-Applied Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings; 2024.

L. CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.

M. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; Resilient Floor Covering Institute; October 2011.

N. UL (GGG) - GREENGUARD Gold Certified Products; current listings at http://http://productguide.ulenvironment.com/QuickSearch.aspx.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Schedule the Pre-Installation Meeting with Contractor, Construction Manager, Architect, and Owner.

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

C. Testing of concrete subfloors to be completed Two Weeks prior to Cementitious Underlayment and Flooring System installation.

1.06 SUBMITTALS

A. **Submittals will not be reviewed until all related flooring system submittals and Flooring System Matrix Forms are received.**

B. Visual Observation Report: For existing floor coverings to be removed.

C. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:

1. Moisture and alkalinity (pH) limits and test methods. (Highlight these items.)
2. Manufacturer's required bond/compatibility test procedure.

D. Concrete Sub-Floor Product Data: Provide Manufacturer's published data documenting physical characteristics and product limitations of Mitigation, Cast Underlayment, and Preparation Materials. Also Include:

1. Manufacturer's qualification statement.
2. Certificate: Manufacturer's certification of compatibility with types of flooring applied over Mitigation, Cast Underlayment, and Preparation materials.
3. Test reports indicating compliance with specified performance requirements, performed by the General Contractor.
4. Manufacturer's installation instructions.

E. **Concrete Sub-Floor Testing Report:**

1. Description of areas tested; including floor plans and photographs illustrating the exact test locations.
2. Summary of conditions encountered.
3. Moisture and alkalinity (pH) test reports.
4. Copies of specified test methods.
5. Recommendations for mitigation of unsatisfactory surfaces for each condition and proposed finish.
6. Product data for recommended mitigation coating.
7. Certificate: Include certification of accuracy by authorized official of testing agency.
8. Impact of mitigation on project schedule.
9. Submit report to Architect.
10. Submit report not more than two business days after conclusion of testing.

F. Wood-Based Sub-Floor Product Data: Manufacturer's published data on each product to be used.

1. Certificate: Manufacturer's certification on compatibility with types of flooring applied over subfloor underlayment product assembly.
2. Manufacturer's installation instructions.

G. **Flooring Installation System Schedule**: In the provided Flooring System Matrix, list the following for each specific combination of substrate, floor covering, and adhesive to be used, in order from substrate to finished floor, including any steps required bewteen products.:

1. Substrate
2. Assessment of existing surface condition(s).
   a. Note: Not all surfaces are visible prior to award. Qualified bidders are assumed to have adequate experience to reasonably infer conditions based on building age, substrate, space type/use, and other observable conditions.
3. Patching Material and Underlayments
4. Remedial Floor Coating for all flooring system types as required by Drawings as well as should the test results require it.
   a. Preparation, Cast Underlayment, and Floor covering moisture and alkalinity limits and manufacturer's testing requirements for moisture and alkalinity.
5. Adhesive
6. Floor Covering
7. Seaming material (grout, heat welds, etc)
8. Provide written documentation of manufacturer's warranty and written verification that combination of installation system products are compatible Refer to floor finish specifications for minimum system warranty requirements.

H. Adhesive Bond and Compatibility Test Report.

I. Copy of RFCI (RWP): Maintain on site.

J. Specimen Warranty and Letter: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty. Provide manufacturer's letter indicating floor preparation system is compatible with the flooring product to be installed to ensure maximum warranty.

1. Where System Warranty is specified for installation of Floor Covering, provide products listed by manufacturer of installation system as acceptable for inclusion under that System Warranty.

1.07 QUALITY ASSURANCE

A. Post-bid moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor. Contractor may conduct testing with their own personnel meeting qualifications listed in Testing Agency Qualifications below.

B. Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.

C. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified for not less than five years.

1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.

D. Contractor's Responsibility Relating to Independent Agency Testing:

1. Provide access for and cooperate with testing agency.
2. Confirm date of start of testing at least 10 days prior to actual start.
3. Allow at least 4 business days on site for testing agency activities.
4. Achieve and maintain specified ambient conditions.
5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

E. Source Limitations: Obtain floor Concrete Floor Slab Preparation for Mitigation, Cast Underlayment, and Preparation products from a single manufacturer.

F. Mitigation Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least five years' experience installing moisture emission coatings.

G. Applicator Qualifications: Company specializing in performing the work of this section, and approved by manufacturer.

H. Mock-Ups: Install mock-ups per sections listed in "Related Requirements" to verify the complete flooring system demonstrate aesthetic effects and set quality standards for materials.

1.08 PRE-INSTALLATION MEETING

A. The following is a list of required attendees:

1. Owner or Owner's Representative
2. Architect.
3. Construction Manager.
4. General Contractor.
5. All subcontractors involved in removals, remediation, preparation, or installation of all flooring in work areas.

B. The following constitutes mandatory discussion items:

1. Finalize construction schedule and ensure availability of materials, installer's personnel, equipment, and facilities needed to avoid delays. Required Concrete Testing shall be a major item of consideration in Schedule, as successful installation of flooring materials depends on proper testing and assessment of test results.
2. Review existing flooring material removal procedures and Owner notifications.
3. Review requirements of 09 0561 - Common Work Results for Flooring Preparation.
4. Review requirements of all flooring material installation as indicated within each flooring material specification sections.
5. Review Flooring Installation System Schedule.
6. Ensure substrate conditions and finishes are in compliance with requirements, including flatness and cleanliness.
7. Start of flooring Work constitutes acceptance of surfaces to be covered and contractors adherence to the criteria in this specification.
8. Finalize "On Site Storage" arrangements for flooring materials.
9. Cover temporary protection requirements for flooring system during and after installation.
10. Review proposed methods and procedures related to flooring installation, including manufacturer's written instructions, and reach aggreement to their conformence. Ensure that 50-70 kilogram roller is used on the project where required by specifications and manufacturer's recommendations.
11. Outline flooring observation and repair procedures after installation.
12. Set procedure for preserving the environmental conditions of the spaces where flooring installations shall take place.

13. Stress intent of mock-up is to verify selections made under sample submittals, demonstrate aesthetic effects, and set quality standards for materials and execution based on concrete slab testing results, use of Manufacturer Certified Installers, addition of underlayments when necessary, and on site supervision with complete understanding of importance of adherence to manufacturer's instructions.
14. Review mock-up requirements, and determine mock-up locations and review schedule.

1.09 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for additional requirements.
B. Construct one mock-up, 4 feet long by 4 feet wide, indicating full system installation for all types of floor coverings in project..
C. Locate where directed by Architect.
D. Mock-up may remain as part of work, if in an undisturbed condition at the time of substatial completion.

1.10 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.
B. Deliver, store, handle, and protect products in accordance with manufacturer’s instructions and recommendations.
C. Deliver materials in manufacturer’s packaging; include installation instructions.
D. Keep materials dry and protect from direct sun exposure, freezing, and ambient temperature greater than105 Degrees F.

1.11 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.
B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.
C. Do not install cast underlayment until floor penetrations and peripheral work are complete.
D. During the curing process, ventilate spaces to remove excess moisture.

1.12 WARRANTY

A. See Section 01 7400 - Warranties and Bonds, for additional warranty requirements.
B. Correct defective Work within a five year period after Date of Substantial Completion.
C. Where System Warranty is specified for installation of Floor Covering, products of this section shall be included as part of that System Warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Proivde Mitigation, Cast Underlayment, and Preparation products by one of the following:
   1. ARDEX Engineered Cements; www.ardexamericas.com..
   2. CMP Specialty Products; www.cmpsp.com.
   3. Custom Building Products; www.custombuildingproducts.com.
   4. LATICRETE International, Inc; www.laticrete.com/#sle.
   5. MAPEI; www.mapei.com.
   6. Substitutions: See Section 01 6000 - Product Requirements.
B. Source Limitations: Furnish all products produced by single manufacturer and obtained from single supplier.
   1. If tile is required, all tile installation products need to be produced by same manufacturer as the mitigation, cast underlayment and floor prep and obtained from single supplier

2.02 APPLICATIONS

A. **Preparation**: Use Self-Leveling Compound or Patching Compound products at all areas receiving new floor finishes. Maximium thickness 1/8 inch, or thickness required to comply with manufacturer's requirements.
B. **Preparation:** Use Ramping Compound products at all areas receiving new floor finishes where there is a change in floor elevation. Maximium thickness 1 inch, or thickness required to comply with manufacturer's requirements and ADA Standards.
C. **Cast-Underlayment:** Use Cast-Underlayment products at all areas requiring infill to slab depressions. Minimum thickness 3/4 inch. Maximium thickness as required to complete floor finish condititions inidcated in the contract documents.

D. **Mitigation:** Use Mitigation Coating at all areas where the slab moisture content exceeds the allowable range of the manufacturer's requirements.

2.03 MATERIALS

A. **Patching Compound:** Floor covering manufacturer's recommended or approved product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
   1. Calcium-aluminate cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
   2. Latex or polyvinyl acetate additions are permitted.
   3. Gypsum content is prohibited.
   4. Compressive Strength: 3,000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M.
   5. Thickness: 1/8 inch, maximum.
   6. Products:
      a. ARDEX Engineered Cements ; ARDEX SKM: www.ardexamericas.com/#sle.
      b. CMP Specialty Products; Prepstar: www.cmpsp.com
      c. Custom Building Products; Custom Tech Silk Patching & Finishing Compound: www.custombuildingproducts.com.
      d. LATICRETE International, Inc; NXT Skim: www.laticrete.com/#sle.
      e. MAPEI; Planiprep SC: www.mapei.com.
   7. Provide manufacturer's recommended primer when required by substrate surface conditions.

B. **Self-Leveling Compound:** Floor covering manufacturer's recommended or approved product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
   1. Self-leveling self-smoothing cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
   2. Gypsum content is prohibited.
   3. Compressive Strength: 4,000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M.
   4. Flexural Strength: 1,000 psi, minimum, after 28 days, when tested in accordance with ASTM C348.
   5. Thickness: 1/8 inch, maximum.
   6. May be used in conjunction with or in lieu of patching compound at the Contractor's option.
   7. Products:
      a. ARDEX Engineered Cements; ; V 1200: www.ardexamericas.com.
      b. CMP Specialty Products; Liquicem: www.cmpsp.com
      c. Custom Building Products; LevelQuik RS: www.custombuildingproducts.com
      d. LATICRETE International, Inc; LATICRETE NXT Level Plus : www.laticrete.com/#sle.
      e. MAPEI; ; Ultraplan 1 Plus; www.mapei.com.
      f. Substitutions: Not permitted.

C. **Ramping Compound:** Floor covering manufacturer's recommended or approved product, for use in conjunction with or in lieu of Patching Compound above, in trowelable consistency for filling of small areas or making transitions between flooring materials of varying depths.
   1. Gypsum content is prohibited.
   2. Compressive Strength: 4,000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M.
   3. Flexural Strength: 1,000 psi, minimum, after 28 days, when tested in accordance with ASTM C348.
   4. Thickness: 1 inch, maximum.
   5. Products:
      a. ARDEX Enigeered Solutions; SD-P / SD-P Rapid : www.ardexamericas.com.
      b. CMP Specialty Products; Rampstar: www.cmpsp.com
      c. Custom Building Products; Custom Tech TechPatch RP: www.custombuildingproducts.com.
      d. LATICRETE International, Inc; NXT Patch: www.laticrete.com/#sle.
      e. MAPEI; Topcem Premix: www.mapei.com.
      f. Substitutions: Not permitted.
   6. Provide manufacturer's recommended primer when required by substrate surface conditions.

D. **Moisture Mitigation Coating:** Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for application of preparation and installation products for proposed flooring.

1. Material: Comply with ASTM F3513 .
2. Verify product is tested by its manufacturer to resist the migration of solvents used during removal of flooring or adhesives to degree sufficient to meet flooring installation manufacturer's recommendations, and suitable for adhesion of flooring without further treatment.
3. Thickness: As required for application and in accordance with manufacturer's installation instructions.
4. Products:
   a. ARDEX Engineered Cements; ARDEX MC RAPID: www.ardexamericas.com/#sle.
   b. CMP Specialty Products; Lock Down: www.cmpsp.com
   c. Custom Building Products; TechMVC Moisture Vapor and Alkalinity Barrier: www.custombuildingproducts.com/#sle.
   d. LATICRETE International, Inc ; LATICRETE NXT Vapor Reduction Coating: www.laticrete.com/#sle.
   e. MAPEI; ; Planiseal VS: www.mapei.com.
   f. Substitutions: Not permitted.
5. Provide manufacturer recommended primer between barrier and levelling products.
6. VOC Content: Materials, except primers, to be certified as Low Emission by one of the following:
   a. Product listing in UL (GGG).
   b. Product listing in CHPS (HPPD).

E. **Cementitious Underlayment:** subject to conformance with specifications, install one of the following products. Not all products listed are apppropriate for all field conditions. Submit multiple products if neccessary, indicating the proposed locations for installtion of each product, including primers and aggregate where required.

1. Compressive Strength: Minimum 4500 pounds per square inch after 28 days, tested per ASTM C109/C109M.
2. Flexural Strength: Minimum 1000 psi after 28 days, tested per ASTM C348.
3. Density: 125 pounds per cubic foot, nominal.
4. Final Set Time: 1-1/2 to 2 hours, maximum.
5. Thickness: Capable of thicknesses from feather edge to maximum 3-1/2 inch.
6. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0 in accordance with ASTM E84.
7. Products:
   a. ARDEX Engineered Cements; ARDEX V 1200 with ARDEX P51 Primer: www.ardexamericas.com/#sle.
   b. CMP Specialty Products; ; Level-1 with AS-100 Primer: www.cmpsp.com.
   c. Custom Building Products; TechLevel XP-1 Self-Leveling Underlayment: www.custombuildingproducts.com/#sle.
   d. LATICRETE International, Inc; LATICRETE NXT Level Plus with NXT Primer: www.laticrete.com/#sle.
   e. MAPEI; www.mapei.com.
   f. Substitutions: Not permitted.
8. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to underlayment mix materials.
9. Primer: Manufacturer's recommended type.
10. Joint and Crack Filler: Latex based filler, as recommended by manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.

3.02 PREPARATION

A. General Preparation
   1. Perform following operations in the order indicated:
      a. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
         1) Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
         2) Removal of existing floor covering.
      b. Existing concrete slabs with coatings or penetrating sealers/hardeners/dustproofers:
         1) Do not attempt to remove coating or penetrating material.
         2) Do not abrade surface.
      c. Preliminary cleaning.
      d. Required Testing:
         1) Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.

2) Internal Relative Humidity Testings: 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
3) Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.

e. Install specified mitigation, if required.
f. Patching, smoothing, and leveling, as required.
g. Other preparation specified or required by flooring installtion products or warranties.
h. Adhesive bond and compatibility test.
i. Protection of prepared surfaces until time of flooring installation.

2. Mitigations:
a. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other mitigation; re-test after correction.
b. Excessive Moisture Emission or Relative Humidity: Apply moisture mitigation coating over entire suspect floor area.
c. Excessive Alkalinity (pH): If moisture mitigation coating is required, no additional mitigation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

B. Removals
1. Comply with local, State, and federal regulations and recommendations of RFCI (RWP), as applicable to floor covering being removed.
2. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.
3. Preliminary Cleaning
a. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
b. Do not use solvents or other chemicals for cleaning.

C. Testing
1. Moisture Vapor Emission
a. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
b. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
c. Test in accordance with ASTM F1869 and as follows.
d. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
e. In the event that test values exceed floor covering manufacturer's limits, perform mitigation as indicated. In the absence of manufacturer limits, perform mitigation if test values exceed 3 pounds per 1000 square feet per 24 hours.
f. Report: Report the information required by the test method.
2. Internal Relative Humidity
a. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
b. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
c. Test in accordance with ASTM F2170 Procedure A and as follows.
d. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.
e. In the event that test values exceed floor covering manufacturer's limits, perform mitigation as required by the manufacturer. In the absence of manufacturer limits, perform mitigation if any text value exceeds 75 percent relative humidity.
f. Report: Report the information required by the test method.
3. Alkalinity
a. In the event that test values exceed floor covering manufacturer's limits, perform mitigation as indicated. In the absence of manufacturer limits, perform mitigation if any test value exceeds 75 percent relative humidity.
b. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
c. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
1) Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
2) Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.

d. In the event that test values exceed floor covering manufacturer's limits, perform mitigation as indicated. In the absence of manufacturer limits, perform mitigation if alkalinity (pH) test value is over 10.

4. Adhesive Bond and Compatibility Testing
   a. Comply with requirements and recommendations of floor covering and adhesive manufacturers.

3.03 INSTALLATION

A. **Application of Preparation Products:** Comply with requirements and recommendations found within this specification and of manufacturer.

B. **Application of Mitigation Products:** Comply with requirements and recommendations found within this specication and of treatment manufacturer.

C. **Application of Cast Underlayment Products:** Comply with requirements and recommendations found within this specication and of treatment manufacturer.

1. Pump or pour material onto substrate. Do not retemper or add water.
   a. Pump, move, and screed while the material is still highly flowable.
   b. Be careful not to create cold joints.
2. Place to required thickness, with top surface level to 1/8 inch in 10 ft.
3. For final thickness greater than that approved by manufacturer for single application, place underlayment in layers. Allow initial layer to harden to the point where the material has lost its evaporative moisture. Immediately prime and begin application of the subsequent layer within 24 hours.
4. Place before partition installation.
5. Where additional aggregate has been used in the mix, add a top layer of neat mix (without aggregate), if needed to level and smooth the surface.
6. If a fine, feathered edge is desired, steel trowel the edge after initial set, but before it is completely hard.

D. Curing:

1. Once underlayment starts to set, prohibit foot traffic until final set has been reached.
2. Air cure in accordance with manufacturer's instructions.

3.04 CLEANING

A. See Section 01 7700 - Closeout Procedures for additional requirements.

3.05 PROTECTION

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

B. Protect against direct sunlight, heat, and wind; prevent rapid drying to avoid shrinkage and cracking.

C. Do not permit traffic over unprotected floor underlayment surfaces.

END OF SECTION

SECTION 09 2116 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.
B. Metal stud wall framing.
C. Metal channel ceiling framing.
D. Acoustic Batts.
E. Gypsum sheathing.
F. Cementitious backing board.
G. Gypsum wallboard.
H. Joint treatment and accessories.
I. Acoustic (sound-dampening) wall and ceiling board.
J. Bullet resistant sheathing.

1.02 RELATED REQUIREMENTS

A. Section 05 4000 - Cold-Formed Metal Framing: Structural steel stud framing.
B. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.
C. Section 07 8400 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.

1.03 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016.
B. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2010 (Reaffirmed 2016).
C. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2016).
D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
F. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.
G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
H. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.
I. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.
J. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.
K. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.
L. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.
M. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.
N. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.
O. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.
P. ASTM C1325 - Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units; 2014.
Q. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.
R. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2015.
S. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.
T. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
U. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.
V. ASTM E413 - Classification for Rating Sound Insulation; 2010.

W. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.
X. ASTM E1414/E1414M - Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum; 2016.
Y. CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
Z. GA-216 - Application and Finishing of Gypsum Board; 2013.
AA. UL (FRD) - Fire Resistance Directory; current edition.
BB. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.
CC. UL (GGG) - GREENGUARD Gold Certified Products; current listings at http://http://productguide.ulenvironment.com/QuickSearch.aspx.
DD. UL 752 - Standard for Bullet-Resisting Equipment; Current Edition, Including All Revisions.
EE. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
   1. Provide perimeter and penetration details complying with Acoustic Ratings indicated.
   2. Provide perimeter and penetration details complying with Fire Ratings indicated.
   3. Indicate UL-listed assemblies and components per UL (FRD).
   4. Provide special details required for bullet resitant sheathing.
B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
D. Test Reports: For stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.
E. Test Reports: Bullet resistant sheathing and wallboard.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum five years of experience.
B. Copies of Documents at Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements, or proof on access to full text of documents via electronic delivery.

PART 2 PRODUCTS

2.01 GYPSUM AND CEMENT BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.
   1. See PART 3 for finishing requirements.
B. Interior Partitions: Provide completed assemblies with the following characteristics:
   1. Deflection: Sustained loads of 5 lbf/sq ft with maximum mid-span deflection of L/360.
      a. Lobbies and Corridors with exterior doors: Intermittent loads of 7.5 lbf/sq ft with maximum mid-span deflection of L/360.
      b. Vestibules: Intermittent loads of 10 lbf/sq ft with maximum mid-span deflection of L/360.
   2. Acoustic Attenuation: STC as indicated calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90, unless otherwise indicated.
C. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
   1. Air Pressure Within Shaft: Sustained loads of 7.5 lbf/sq ft with maximum mid-span deflection of L/360.
   2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
D. Fire Rated Assemblies: Provide complete UL Listed assemblies complying with applicable code, or as indicated, whichever is greater.
   1. Fire Rated Partitions: UL listed assemblies, with fire ratings indicated.
   2. Head of Fire Rated Partitions: UL listed deflection assembly compatible with wall type.
   3. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. ClarkDietrich: www.clarkdietrich.com/#sle.
   2. Marino: www.marinoware.com/#sle.
   3. R-stud, LLC: www.rstud.com/#sle.
   4. SCAFCO Corporation: www.scafco.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/360 at 5 psf, or as required for assembly indicated.
   1. Studs: C-shaped with knurled or embossed faces.
   2. Runners: U shaped, sized to match studs.
   3. Ceiling Channels: C-shaped.
   4. Furring: Hat-shaped sections, minimum depth of 7/8 inch, unless otherwise indicated.
   5. Resilient Furring Channels: 1/2 inch depth, for attachment to substrate through one leg only.
   6. Resilient Sound Isolation Clips: Steel resilient clips with molded rubber isolators, attached to framing; improves noise isolation performance of wall and floor-ceiling assemblies.
      a. Products:
         1) ClarkDietrich; Sound Clip (CDSC): www.clarkdietrich.com/#sle.
         2) Keene Building Products; Cylent Assurance Clip: www.keenebuilding.com/#sle.
         3) PAC International, Inc; RSIC-1: www.pac-intl.com/#sle.
         4) Substitutions: See Section 01 6000 - Product Requirements.

C. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.

D. Ceiling and Soffit Framing: Provide for Board attachment at 16 inches on center maximum, unless otherwise indicated.

E. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
   2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.
   3. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems of fire rating and movement required.
   4. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-resistance rating of the wall assembly.
   5. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 12 feet.

F. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.

G. Preformed Top Track Firestop Seal:
   1. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems specified in Section 078400.
   2. Products:
      a. Hilti, Inc; Top Track Seal CFS TTS: www.us.hilti.com/#sle.
      b. Specified Technologies Inc; SpeedFlex TTG Track Top Gasket: www.stfirestop.com/#sle.
      c. Substitutions: See Section 01 6000 - Product Requirements.

H. Non-structural Framing Accessories:
   1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
   2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
      a. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.
   3. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.
      a. Products:
         1) Substitutions: See Section 01 6000 - Product Requirements.

I. Grid Suspension Systems: Steel grid system of main tees and support bars connected to structure using hanging wire.
   1. Products:
      a. USG Corporation; Drywall Suspension System: www.usg.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. American Gypsum Company: www.americangypsum.com/#sle.
   2. CertainTeed Corporation: www.certainteed.com/#sle.
   3. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
   4. National Gypsum Company: www.nationalgypsum.com/#sle.
   5. USG Corporation: www.usg.com/#sle.
   6. Substitutions: See Section 01 6000 - Product Requirements.

B. Gypsum Board and Panel Products shall be manufactured within the Continental United States and Canada, by members of the Gypsum Association group of companies.

C. Provide panels manufactured with 100% Synthetic Gypsum cores.

D. Gypsum Wallboard (GWB): Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
4. VOC Content: Certified as Low Emission by one of the following:
    a. Product listing in UL (GGG).
    b. Product listing in CHPS (HPPD).
5. Thickness:
    a. Vertical Surfaces: 5/8 inch, unless otherwise indicated.
    b. Ceilings: 1/2 inch, unless otherwise indicated.
    c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
6. Mold Resistant Paper Faced Products:
    a. American Gypsum Company; M-Bloc Type X: www.americangypsum.com/#sle.
    b. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard: www.gpgypsum.com/#sle.
    c. National Gypsum Company; Gold Bond XP Gypsum Board: www.nationalgypsum.com/#sle.
    d. Substitutions: See Section 01 6000 - Product Requirements.

E. Abuse Resistant Wallboard:

1. Application: High-traffic areas indicated.
    a. Lobbies.
    b. Vestibules.
    c. Corridors.
    d. Stairwells.
    e. Ramps.
    f. Vocational shops and labs.
2. Surface Abrasion: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
4. Soft Body Impact: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
5. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
6. Paper-Faced Type: Gypsum wallboard, as defined in ASTM C1396/C1396M.
7. Type: Fire-resistance-rated Type X, UL or WH listed.
8. Thickness: 5/8 inch.
9. Edges: Tapered.

F. Impact Resistant Wallboard:

1. Application: Impact-prone areas indicated.
    a. Locker rooms.
    b. Team rooms.
    c. Gymnasiums.
    d. Physical therapy spaces.
2. Surface Abrasion: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
4. Soft Body Impact: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
5. Hard Body Impact: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
6. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
7. Paper-Faced Type: Gypsum wallboard, as defined in ASTM C1396/C1396M.
8. Type: Fire-resistance-rated Type X, UL or WH listed.
9. Thickness: 5/8 inch.
10. Edges: Tapered.

G. Backing Board For Wet Areas:

1. Application: Surfaces behind tile in wet areas including tub and shower surrounds and wet walls inside toilet rooms.
    a. Use behind tile in all areas inside locker rooms, team rooms, and kitchens.

2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
    a. Thickness: 5/8 inch.
    b. Products:
        1) Custom Building Products; WonderBoard Lite: www.custombuildingproducts.com/#sle.
        2) National Gypsum Company; PermaBase Cement Board: www.nationalgypsum.com/#sle.
        3) USG Corporation; Durock: www.usg.com.
        4) Substitutions: See Section 01 6000 - Product Requirements.

H. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
1. Application: Vertical surfaces behind thinset tile, except in wet areas.
    a. Installer Option: Where tile does not extend the full height of a wall, backing board may extend beyond tile to full height of wall in lieu of regular GWB.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
4. Type: Regular and Type X, in locations indicated.
5. Type X Thickness: 5/8 inch.
6. Regular Board Thickness: 5/8 inch.
7. Edges: Tapered.
8. Products:
    a. American Gypsum Company; M-Bloc Type X: www.americangypsum.com/#sle.
    b. Georgia-Pacific Gypsum; ToughRock Mold-Guard Gypsum Board: www.gpgypsum.com/#sle.
    c. National Gypsum Company; Gold Bond XP Gypsum Board: www.nationalgypsum.com/#sle.
    d. Substitutions: See Section 01 6000 - Product Requirements.

I. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings, unless otherwise indicated.
2. Thickness: 1/2 inch.
    a. Option: 5/8 inch Gypsum Wall Board may be used in lieu of Ceiling Board, with proper adjustments to framing.
3. Edges: Tapered.

J. Acoustical Sound Dampening Wall and Ceiling Board: high-density gypsum composite board capable of achieving STC rating equal to Basis of Design product or more in typical stud wall assemblies as calculated in accordance with ASTM E413 and when tested in accordance with ASTM E90.
1. Products:
    a. Basis of Design: Quietrock THX 545.
    b. Thickness: 5/8 inch.
        1) Long Edges: Tapered.
        2) Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

K. Bullet Resistant Sheathing and Wallboard: Woven roving, multi-ply, ballistic grade fiberglass cloth with thermoset polyester resin; comply with UL 752 Level 3.

L. Shaftwall and Coreboard: Type X; 1 inch thick by 24 inches wide, beveled long edges, ends square cut.
1. Paper-Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

2.04 GYPSUM WALLBOARD ACCESSORIES

A. Acoustic Batts: Mineral Fiber, Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.

B. Sound Isolation Tape: Elastomeric foam tape for sound decoupling.
1. Surface Burning Characteristics: Provide assemblies with flame spread index of 75 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
2. Tape Thickness: 1/4 inch.

C. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
1. Products:

a. Franklin International, Inc; Titebond GREENchoice Professional Acoustical Smoke and Sound Sealant: www.titebond.com/#sle.
b. Liquid Nails, a brand of PPG Architectural Coatings: www.liquidnails.com/#sle.
c. Specified Technologies Inc; Smoke N Sound Acoustical Sealant: www.stifirestop.com/#sle.
d. Substitutions: See Section 01 6000 - Product Requirements.

D. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
1. Corner Beads: Low profile, for 90 degree outside corners.

E. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
1. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
2. Joint Compound: Drying type, vinyl-based, ready-mixed.

F. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
1. Products:
a. CertainTeed Corporation; Level V Wall and Ceiling Primer/Surfacer with M2Tech: www.certainteed.com/#sle.
b. USG Corporation; USG Sheetrock Brand Tuff-Hide Primer-Surfacer: www.usg.com/#sle.
c. Substitutions: See Section 01 6000 - Product Requirements.

G. Extruded Moldings: Extruded 6063 aluminum in accordance with ASTM B221, with perforated tape flanges for GWB application.
1. Trim: L-Style for application at edge of GWB. (Gordon 200 Series)
2. Corner: Structural Corner for application at 90 degree outside corners in high abuse areas. (Gordon 901 Series)
3. Corner: Outside Corner for application to non-90 degree outside corners. (Gordon 980 Series)
4. Reveal: Z-Style for application at edge GWB to create shadow line at interface with other meterials. (Gordon 300 Series)
5. Reveal: F-Style for application at edge GWB to create shadow line at interface with other meterials. (Gordon 400 Series)
6. Reveal: U-Style for application at in field of GWB to create shadow line. (Gordon 500 Series)
7. Transition: Z-Style for application at change of thickness in GWB. (Gordon 903 Series)
8. End Cap: For use in cased openings, wall terminations, and capping of kneewalls where indicated. (Gordon 911 Series)
9. Provide matching inserts, alignment devices, and end closures.
10. Finish: Clear anodized, where exposed surface of trim is not intended to be painted.
11. Finish: factory primed for field painting.
12. Products:
a. Gordon Interior Specialties; Final Forms: www.gordon-inc.com. (Basis-of-Design)
b. Fry Reglet Architectural Metals; Drywall Reveals; www.fryreglet.com.
c. Pittcon Industries; Softforms; www.pittconindustries.com.
d. Tamlyn; XtremeInterior Corner Trim: www.xtremeias.com.
e. Other manufacturers demonstrating compliance with Specifications and Basis-of-Design Product.

H. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

I. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

J. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
1. Install studs at spacing required to meet performance requirements.

B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.

3.03 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members at 16 inches on center.
1. Level ceiling system to a tolerance of 1/1200.
2. Laterally brace entire suspension system.
3. Install bracing as required at exterior locations to resist wind uplift.

C. Studs: Space studs at 16 inches on center.
   1. Extend partition framing to structure in all locations unless otherwise indicated.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
   3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Standard Wall Furring: Install at masonry walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
   1. Orientation: Horizontal.
   2. Spacing: As indicated.

F. Blocking: Install wood blocking for support of wall and ceiling mounted items including but not limited to:
   1. Framed openings.
   2. Wall-mounted cabinets.
   3. Wall-mounted door hardware.

3.04 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Sound Isolation Tape: Apply to vertical studs and top and bottom tracks/runners in accordance with manufacturer's instructions.

C. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.05 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Double-Layer Non-Rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

D. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

E. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

F. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

G. Bullet Resistant Sheathing and Wallboard:
   1. Install bullet-resistant sheathing according to manufacturer's written recommendations and with manufacturer-approved fasteners.

3.06 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.07 JOINT TREATMENT

A. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.

B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish (MPI G5 or greater) and other areas specifically indicated.
   2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   3. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.

C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.

D. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

E. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.08 TOLERANCES

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

END OF SECTION

SECTION 09 3000 - TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for wall applications.
B. Non-ceramic trim.
C. Setting Materials, Grouts, Maintenance Materials & Accessory Materials

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
B. Section 09 0561 - Common Work Results for Flooring Preparation.
C. Section 09 2116 - Gypsum Board Assemblies: Tile backer board.

1.03 REFERENCE STANDARDS

A. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2014.
B. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
C. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement; 1999 (Reaffirmed 2010).
D. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship; 2019.
E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2009 (Revised).
F. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (Reaffirmed 2010).
H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2010).
I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 1999 (Reaffirmed 2010).
J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 1999 (Reaffirmed 2010).
K. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2010 (Reaffirmed 2016).
L. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior glue plywood) Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
M. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2010).
N. ANSI A108.17 - Installation of Crack Isolation Membrane; Current Edition.
O. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2017.
P. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium).; 2017.
Q. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2010 (Revised).
R. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation; 2014.
S. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-set Ceramic Tile and Dimension Stone Installation; 2014.
T. ANSI A118.13 - American National Standard Specifications for Bonded Sound Reduction Membranes for Thin-Set Ceramic Tile Installation; 2014.
U. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2012.
V. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2013.1.

W. ANSI A326.3 - Test Method for Dynamic Coefficient of Friction of Hard Surface Flooring Materials; 2017.
X. ASTM C373 - Standard Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products, Ceramic Tiles, and Glass Tiles; 2014a.
Y. CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
Z. EJ171 - Movement Joint Guidelines for Ceramic, Glass, and Stone; Current Edition.
AA. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2015.
BB. UL (GGG) - GREENGUARD Gold Certified Products; current listings at http://http://productguide.ulenvironment.com/QuickSearch.aspx.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.
    1. Review requirements in Section 09 0561 Common Work Results for Flooring Preparation

1.05 SUBMITTALS

A. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
B. Tiling Schedule: on installer's letterhead for each system included in project, including:
    1. Substrate requirements. materials, including required water or vapor proofing properties.
    2. Installation Method per TCNA (HB).
    3. List of proposed materials in order from substrate to finished surface, including surface preparation, water or vapor proofing products, membranes, setting materials, tiles, trims, thresholds, grouts, and sealers.
        a. Tag specific tile products with Architect's tile and color designations.
        b. Indicate materials included in manufacturer's Installation System Warranty.
    4. Installation System Warranty.
C. Shop Drawings: Indicate tile layout, patterns, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, setting details, and non-ceramic trim.
D. Selection Samples: For each finish where color selection is not indicated or proposed material varies from Basis-of-Design, provide two sets of color chips representing proposed manufacturer's full range of finishes, colors and textures.
    1. Where product specific color, pattern, or texture is indicated, proposed products of other manufacturers must be available in adequately matching color, pattern, and texture, at the sole discretion of the Architect.
    2. Where other non-basis-of-design manufacturers are listed without colors, they may be considered of like quality, but is not meant to imply that those manufacturer's offer adequately matching products for all types required.
E. Installer's Qualification Statement:
    1. Submit documentation of National Tile Contractors Association (NTCA) or Tile Contractors' Association of America (TCAA) accreditation.
    2. Submit documentation of completion of apprenticeship and certification programs.
F. Manufacturer Qualifications Statement.
G. Installer Qualifications Statement.
H. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 01 6000 - Product Requirements, for additional provisions.
    2. Extra Tile: 5 percent of each size, color, and surface finish combination, but not less than 25 SF of each type.
        a. Extra materials that match and are from same production runs as products installed and are packaged with protective covering for storage and identified with labels describing contents.
    3. Grout: Furnish quantity of grout equal to 5 percent of amount installed for each type, composition, and color indicated.

1.06 QUALITY ASSURANCE

A. Maintain one copy of and ANSI A108/A118/A136 and TCNA (HB) on site.
B. Source Limitations:
    1. For Tile: Obtain tile of each type and color or finish from one source or producer.
        a. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
    2. For Setting, Grouting and Accessory Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.
    3. For Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:

a. Stone thresholds.
b. Joint sealants.
c. Cementitious backer units.
d. Metal edge strips.

C. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum ten years of documented experience.

D. Installer Qualifications:
1. Company specializing in performing tile installation, with minimum of five years of documented experience.
a. Accredited Five-Star member of the National Tile Contractors Association (NTCA) or Trowel of Excellence member of the Tile Contractors' Association of America (TCAA).
2. Installer Certification:
a. Advanced Certifications for Tile Installers (ACT): Certification in the installation of membranes, mortar bed (mud) floors, shower receptors, large format tile, gauged porcelain tile/panels/slabs, and grouts.

1.07 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for general requirements for mock-up.

B. Construct tile mock-up where indicated on drawings, incorporating all components specified for the location.
1. Minimum size of mock-up: as indicated on drawings or as required to demonstrate pattern repeat in two directions.
2. Approved mock-up may remain as part of the Work, if undisturbed at the time of substantial completion.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

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

D. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.09 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

C. Do not install tile until construction in spaces is complete and ambient temperature and humidty conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.10 WARRANTY

A. See Section 01 7400 - Warranties and Bonds, for additional warranty requirements.

B. Special Project Warranty: Submit tile Installer's warranty, signed by Installer, covering Work of this and associated Sections, including including surface preparation, water or vapor proofing products, membranes, setting materials, tiles, trims, thresholds, grouts, and sealers for the following warranty period:
1. Warranty Period: 2 years from date of Substantial Completion.

C. Installation System Warranty: Provide manufacturer's system warranty, executed per the manufacturer's requirements, agreeing to repair or replace defective materials, including labor and materials, and as follows:
1. Warranty Term: Lifetime of installation from date of Substantial Completion.
2. Warranty shall include repair or replacement of tile and trim directly affected by failure of covered materials.
3. Limit of Liability: No Dollar Limitation. (NDL)

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Dynamic Coefficient of Friction: For tile installed on walking surfaces, provide products with the following values when tested in accordance with ANSI A326.3:
1. Level Surfaces: Minimum 0.42 when wet.
2. Stair Treads/Ramps: Minimum 0.65 when wet.

3. Kitchens and Serving Areas: 0.60 when wet.
4. Swimming Pools and Decks: 0.60 when wet.

B. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
1. Level Surfaces: Minimum 0.6.
2. Step Treads: Minimum 0.6.
3. Ramp Surfaces: Minimum 0.8.

2.02 TILE

A. Glazed Wall Tile, Type TILE-01, TILE-02, TILE-03: ANSI A137.1 standard grade.
1. Products: As indicated in drawings.
a. Substitutions: See Section 01 6000 - Product Requirements.
2. Thickness: 5/16 inch.
3. Shape: Rectangle.
4. Edges: Cushioned.
5. Surface Finish: High gloss.
6. Color(s): To be selected by Architect from manufacturer's full range.
7. Grout Width: 1/16 inch.
8. Grout Color: To be selected from manufacturer's full range.
9. Trim Units: Matching bead, bullnose, cove, and base shapes in sizes coordinated with field tile.
10. Metal Trim: Provide metal trim as follows, unless indicated otherwise.
a. Exposed ends: Schluter; JOLLY.
b. Outside corners: Schluter; RONDEC.
c. Exposed top edge: Schluter; JOLLY.
d. Transition at flooring: Schluter; RENO-U.
e. Finish: brushed aluminum.

B. Ceramic Tiles, Type TILE-04: ANSI A137.1 standard grade.
1. Products: As indicated in drawings
a. Substitutions: See Section 01 6000 - Product Requirements.
2. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
3. Size: As indicated on drawings.
4. Color(s): As indicated on drawings.
5. Grout Width: 3/16 inch.
6. Grout Color: To be selected from manufacturer's full range
7. Metal Trim: Provide metal trim as follows, unless indicated otherwise.
a. Exposed ends: Schluter; JOLLY.
b. Outside corners: Schluter; QUADEC.
c. Exposed top edge: Schluter; JOLLY.
d. Transition at flooring: Schluter; RENO-U.
e. Finish: brushed aluminum.

2.03 TRIM AND ACCESSORIES

A. Metal Trim: Extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
1. Applications:
a. As indicated by Tile Types above.
b. As detailed on drawings.
2. Manufacturers:
a. Schluter-Systems: www.schluter.com/#sle.
b. Profilitec: www.profilitec.com/en.html
c. Progress Profiles America, Inc: www.progressprofiles.com
d. Substitutions: See Section 01 6000 - Product Requirements.
3. Accessories: Provide manufacturer's standard splice plates, inside and outside corners and transitions, and termination caps to match profile and finish of trim.

2.04 SETTING MATERIALS

A. Improved Latex-Portland Cement Mortar Bond Coat meeting all requirements of: ANSI A118.15.

1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.
2. Products:
   a. ARDEX Engineered Cements; S 28: www.ardexamericas.com/#sle.
   b. Custom Building Products; Complete Contact-LFT Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer: www.custombuildingproducts.com/#sle.
   c. LATICRETE International, Inc; MULTIMAX LITE: www.laticrete.com/#sle.
   d. MAPEI Corporation; Kerabond/Keralastic: www.mapei.com

2.05 GROUTS

A. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
   1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
   2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
   3. Color(s): As selected by Architect from manufacturer's full line.
   4. Products:
      a. ARDEX Engineered Cements; ARDEX FL: www.ardexamericas.com/#sle.
      b. Bostik Inc; Hydroment: www.bostik-us.com/#sle.
      c. Custom Building Products; Prism Color Consistent Grout: www.custombuildingproducts.com/#sle.
      d. LATICRETE International, Inc; LATICRETE PERMACOLOR Select Grout: www.laticrete.com/#sle.
      e. MAPEI Corporation; Keracolor U: www.mapei.com
      f. ProSpec; ProColor Plus: www.prospec.com.
      g. Substitutions: See Section 01 6000 - Product Requirements.

B. VOC Content: Certified as Low Emission by one of the following:
   1. Product listing in UL (GGG).
   2. Product listing in CHPS (HPPD).

2.06 MAINTENANCE MATERIALS

A. Tile Sealant: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section Joint Sealants.
   1. Applications: Movement joints and between tile and plumbing fixtures.
   2. Sealants shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, subpart D (EPA Method 24)
   3. Color(s): As selected by Architect from manufacturer's full line.
      a. Use installation system manufacturer's selants color-matched to grout, unless otherwise indicated.
   4. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S, Grade NS, Class 25; Uses NT, G, A, and, as applicable to non-porous joint substrates indicate, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other non-porous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
   5. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.

2.07 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories as recommended by manufacturer.
   1. Crack Resistance: No failure at 1/16 inch gap, minimum.
   2. Fluid or Trowel Applied Type:
      a. Thickness: 20 mils, maximum.
      b. Products:
         1) LATICRETE International, Inc; LATICRETE Hydro Ban: www.laticrete.com/#sle.
         2) ARDEX Engineered Cements; ARDEX 8+9: www.ardexamericas.com/#sle.
         3) MAPEI Corporation; Mapelastic HPG: www.mapei.com

B. Waterproofing Membrane at Floor and Walls: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
   1. Crack Resistance: No failure at 1/16 inch gap, minimum; comply with ANSI A118.12.
   2. Fluid or Trowel Applied Type:
      a. Thickness: 25 mils, minimum, dry film thickness.
      b. Products:
         1) ARDEX Engineered Cements; ARDEX 8+9: www.ardexamericas.com/#sle.
         2) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.

3) MAPEI Corporation; Mapelastic HPG: www.mapei.com

c. Locations: For installation at wet areas including but not limited to toilet rooms, locker rooms, and kitchens.
1) Full extent at Floor.
2) Full height application at wet/plubming wall.
3) Full height application at shower.
4) 12 inches up wall at all other areas.

C. Backer Board: as indicated in Section 09 2116 - Gypsum Board Assemblies.

D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.08 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturer's written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

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

C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

D. Verify that concrete sub-floor surfaces are ready for tile installation in accordance with section 09 0561 - Common Work Results for Flooring Preparation.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.19 , manufacturer's instructions, and TCNA (HB) recommendations.
1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
a. Tile floors in wet areas.
b. Tile floors composed of tiles 8 by 8 inches or larger.
c. Tile floors composed of rib-backed tiles.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated and per TCNA (HB) - EJ171. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section JOINT SEALANTS.

D. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

E. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
1. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
2. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

F. Form internal angles square and external angles with trim indicated.

G. Install non-ceramic trim in accordance with manufacturer's instructions.

H. Sound tile after setting. Replace hollow sounding units.

I. Keep control and expansion joints free of mortar, grout, and adhesive.

J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

K. Grout tile joints unless otherwise indicated.

L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding. Lay out movement joints per TCNA (HB) - EJ171, approved shop drawings, and areas indicated below. Do not grout these joints - provide appropriate elastomeric sealant or specified control joint accessory.

1. Perimeter expansion, where Floor Tile meets Wall Tile; not less than ¼ inch and commonly covered by tile trim, cove base, or shoe molding
2. Walls at inside corners.
3. Walls where Wall Tile meets door and window frames.
4. Interior: Maximum of 25ft in each horizontal and vertical direction
5. Exterior: 8ft to 12 ft in each horizontal and vertical direction
6. Interior tilework exposed to direct sunlight (heat) or moisture: maximum of 12 ft in each direction.
7. Where tile meets door frames
8. Where tile meets the floor
9. Where tile abuts another material and no trim is present
10. Tile to Tile inside corners.
11. Above ground concrete slab structure: Maximum of 12 ft in each direction

3.04 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A118.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.05 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.06 INSTALLATION - WALL TILE

A. Method: TCNA (HB) - W202I.

1. Substrate: concrete masonry.
2. Membrane: Crack Isolation membrane applied per TCNA (HB) F125-Partial.
3. Membrane: Waterproofing membrane(s) for applications indicated in Section 2.
4. Setting: Improved Latex-Portland Cement Bond Coat.
5. Grout: Polymer-modified un-sanded.

B. Method: TCNA (HB) - W243.

1. Substrate: water-resistant gypsum board.
2. Membrane: Crack Isolation membrane applied per TCNA (HB) F125-Partial.
3. Membrane: Waterproofing membrane(s) for applications indicated in Section 2.
4. Setting: Improved Latex-Portland Cement Bond Coat.
5. Grout: Polymer-modified un-sanded.

3.07 CLEANING

A. Clean tile and grout surfaces.

B. Remove epoxy and latex-Portland cement grout residue from tile as soon as possible.

C. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

D. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

3.08 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Do not permit traffic over finished floor surface for seven (7) days after installation.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION

SECTION 09 5100 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. (SUSP) Suspended metal grid ceiling system.
B. Suspended plastic grid ceiling system.
C. (APC) Acoustical panels (units)
D. Products furnished, but not installed under this Section include anchors, clips, and other ceiling attachment devices.

1.02 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Acoustical Drywall Ceiling and Wall Systems

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.
B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
D. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021.
E. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.
F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
G. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2009a.
H. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.
I. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.
J. ASTM C834 - Standard Specification for Latex Sealants; 2014.
K. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.
L. ASTM D3274 - Standard Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Microbial (Fungal or Algal) Growth or Soil and Dirt Accumulation; 2017.
M. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
N. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.
O. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.
P. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2014.
Q. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests; 2005 (Reapproved 2012).
R. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.
S. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.
T. Hardwood Plywood & Venner Association (HPVA)

1.04 ADMINISTRATIVE REQUIREMENTS

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

1.05 SUBMITTALS

A. Shop Drawings: Indicate grid layout and related dimensioning, and details of substrate joints, components and attachments to other work.
B. Product Data: Provide data on suspension system components, acoustical units, and each type of product indicated.
C. Samples: Submit one sample 6 by 6 inch in size illustrating material and finish of acoustical units.
D. Samples: Submit one sample each, 6 inches long, of suspension system main runner, cross runner, and perimeter molding.
E. System Description Letter: on installer's letterhead for each system included in project, including:

1. Substrate requirements.
2. List of proposed materials in order from substrate to finished surface, including acoustic panels, suspension systems and accessories
   a. Indicate materials included in manufacturer's Installation System Warranty.
3. Manufacturer's Warranty.

F. Closeout Submittals: Maintenance Data for finishes to include in maintenance manuals

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.
3. Suspension-System Components: Quantity equal to 5 percent of total installed.
4. Hold -Down Clips: Quantity equal to 5 percent of total installed.
5. Impact Clips: Quantity equal to 5 percent of total installed.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to VNLAP for testing indicated.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical ceiling and interior system in area as shown on Drawings or directed by Architect.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at the time of Substantial Completion.

C. Source Limitations: Obtain acoustical system from single source from single manufacturer.

D. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of systems required for this project.

E. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

F. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

G. Woodworking Standards: Manufacturer must comply with specified provisions of Architectural Woodworking Institute quality standards.

H. Coordination of the Work: Coordinate ceiling work with installers of related work including, but not limited to building insulation, wet work i.e. gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers (if applicable).

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels (units), metal, and wood systems, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels (units), metal, and wood systems, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels (units), metal, and wood systems carefully to avoid chipping edges or damaging units in any way.

1.08 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after installation of all products covered in this section.

1. Do not install products covered in this section until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceiling is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
2. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.09 WARRANTY

A. See Section 01 7400 - Warranties and Bonds, for additional warranty requirements.

B. Installation System Warranty: From date of substantial completion, provide manufacturer's standard system warranty, executed per the manufacturer's requirements, agreeing to repair or replace defective materials, including labor and materials, and as follows:

1. Mineral Fiber and Glass Fiber Systems:
   a. Warranty Term: 30-Year Limited Warranty
2. Warranty shall include repair or replacement of acoustic panels and suspension systems directly affected by failure of covered materials.

3. Limit of Liability: No Dollar Limitation. (NDL)

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS, GENERAL

A. Low -Emitting Materials: Acoustical panel ceilings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.

B. Glass-Fiber & Mineral-Fiber Based Panels: Made with binder containing no urea formaldehyde.

C. Acoustical Panel Standard: Provided Manufacturer's standard panels of configuration indicated that comply with ASTM E1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance unless otherwise indicated.
   1. Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   2. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4" inches away from test surface according to ASTM E795.
   3. Smoke Developed Index: 450 or less.
   4. VOC Content: Certified as Low Emission by one of the following:
      a. Product listing in UL (GGG).
      b. Product listing in CHPS (HPPD).

D. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

E. Provide humidity and sag resistant systems such as:
   1. "HumiGuard" by Armstrong
   2. "ClimaPlus" by USG
   3. 140/90-95 by Certainteed

F. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew or bacterial growth when tested according to ASTM D3273 and evaluated according to ASTM D3274 or ASTM G21.

2.02 MANUFACTURERS

A. Acoustical Tiles/Panels (APC):
   1. Armstrong World Industries, Inc: www.armstrong.com/#sle.
   2. CertainTeed Corporation: www.certainteed.com/#sle.
   3. USG: www.usg.com.

B. Suspension Systems (SUSP):
   1. Armstrong World Industries, Inc: www.armstrong.com/#sle.
   2. CertainTeed Corporation: www.certainteed.com/#sle.
   3. USG Corporation; ____: www.usg.com/ceilings/#sle.

2.03 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Rating: Determined in accordance with test procedures in ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

B. Noise reductions Coefficient (Acoustical Plaster): NRC 0.85; ASTM c423 - 07a Test Mounting Type A

2.04 ACOUSTICAL UNITS

A. Acoustical Panels, Type APC-01 + APC-02: Mineral fiber with membrane-faced overlay, with the following characteristics:
   1. Application(s): Classrooms, Offices, Small Group Rooms.
   2. Classification: ASTM E1264 Type A.
      a. Form: 2, water felted.
      b. Pattern: G - smooth.
   3. Size: APC-01 24 by 24 inches; APC-02 24 by 48 inches .
   4. Thickness: 3/4 inch.
   5. Light Reflectance: .88 percent, determined in accordance with ASTM E1264.
   6. NRC Range: .75 to .90, determined in accordance with ASTM E1264.
   7. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.

8. Panel Edge: Reveal.
9. Color: White.
10. Suspension System Type SUSP-A: Exposed grid.
11. Products:
    a. Armstrong World Industries, Inc; Optima: www.armstrongceilings.com/#sle.
    b. USG Corporation; Mars Acoustical Panels: www.usg.com/ceilings/#sle.
    c. CertainTeed; Symphony: www.certainteed.com

2.05 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold-down clips, stabilizer bars, clips, and splices as required.
   1. Materials:
      a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
      b. Aluminum Grid: Aluminum sheet, ASTM B209/B209M.

B. Exposed Suspension System, Type SUSP-A: Hot-dipped galvanized steel grid and cap.
   1. Structural Classification: Heavy-duty, when tested in accordance with ASTM C635/C635M.
   2. Profile: Tee; 15/16 inch face width.
   3. Finish: Baked enamel.
   4. Color: White.
   5. Products:
      a. Armstrong World Industries, Inc; Prelude XL: www.armstrong.com
      b. USG Corporation; Donn Brand ZXLA 15/16 inch Acoustical Suspension System: www.usg.com/ceilings/#sle.
      c. CertainTeed; EZ Stab Classic System: www.certainteed.com

2.06 TRIM AND ACCESSORIES

A. Subject to compliance with requirements, provide products listed below by one of the following:
   1. Armstrong World Industries, Inc: www. armstrong.com.
   2. USG Corporation: www.usg.com/ceilings
   3. CertainTeed Corp.: www.certainteed.com

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
   1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
   2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

C. Extruded-Aluminium Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or reference by manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:
   1. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B221 for Alloy and Temper 6063-T5
   2. Clear Anodic Finish: AAMA 611, AA-M12C2A31, Class II, 0.010 mm or thicker.
   3. Backed-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils. Comply with ASTM C635/C635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

D. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

E. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.

F. Hold-Down Clips: Manufacturer's standard clips to suit application.

G. Seismic Clips: Manufacturer's standard clips for seismic conditions and to suit application.

H. **Perimeter Moldings:** Same metal and finish as grid.
   1. Size: As required for installation conditions.
   2. Shadow Molding: Shaped to create a perimeter reveal.
   3. Acoustical Sealant For Perimeter Moldings: Non-hardening, non-skinning, for use in conjunction with suspended ceiling system.
      a. Acoustical Sealant for Exposed and Concealed Joints:

1) Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant
2) USG Corporation; SHEETROCK Acoustical Sealant

b. Acoustical Sealant for Concealed Joints:
1) Henkel Corporation; OSI Pro-Series SC175 Acoustical Sound Sealant
2) Pecora Corporation; AIS-919
3) Tremco, Inc.; Tremco Acoustical Sealant.

I. **Aluminum Transitions Perimeter Trim**: Transition between APC ceilings of varying heights:
1. Products:
a. Armstrong World Industries, Inc; Axiom Transitions Trim: www.armstrong.com
b. USG Corporation; Compasso Elite Transitions: www.usg.com/ceilings/#sle.
c. CertainTeed: www.certainteed.com
2. Color: Custom Color

J. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction and as demonstrated by testing representative assemblies according to ASTM E90.
1. Exposed and concealed joints: Non-sag, paintable, non-staining latex sealant
2. Concealed Joints: Non-drying, non-hardening, non-skinning, Nonstaining, gunnable, synthetic rubber sealant
3. acoustical sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

K. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Verify existing conditions before starting work.

C. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

D. Verify that layout of hangers will not interfere with other work.

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

3.02 PREPARATION

A. Install after major above-ceiling work is complete.

B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions, as supplemented in this section.
1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.

D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
1. Install in bed of acoustical sealant.
2. Use longest practical lengths.
3. Overlap and rivet corners.

E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

I. Do not eccentrically load system or induce rotation of runners.

3.04 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions. And as indicated on reflected ceiling plans
B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
C. Fit border trim neatly against abutting surfaces.
D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
E. Cutting Acoustical Units:
    1. Make field cut edges of same profile as factory edges.
    2. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
F. Where round obstructions occur, provide preformed closures to match perimeter molding.
G. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements.

3.05 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
    1. Compliance of seismic design.
B. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
C. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations show compliance with requirements.
    1. Extend of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion by no panels have been installed.
        a. Within each test area, testing agency will select one of every 10 power-actuated fasteners and post-installed anchors used to attach hangers to concrete and will test them for 200 lbg of tension; it will also select one of every two post-installed anchors used to attach bracing wires to concrete and will test them from 440 lbf of tension.
        b. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.
D. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.
E. Prepare test and inspections reports.

3.06 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touch up of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 6500 - RESILIENT FLOORING, BASE, AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient tile flooring.
B. Resilient base.
C. Resilient stair accessories.
D. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 0561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

1.03 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2014c.
B. ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials; 2017a.
C. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2014).
D. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012).
E. ASTM F2169 - Standard Specification for Resilient Stair Treads; 2015.
F. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.
G. NFPA 258 - Recommended Practice for Determining Smoke Generation of Solid Materials; 2001.

1.04 PREINSTALLATION MEETINGS

A. Conduct Pre-Installation Conference at Project site to comply with requirements in 01 3000 - Administrative Requirements
B. The following is a list of required attendees:
    1. Owner or Owner's Representative.
    2. Architect.
    3. Construction Manager.
    4. General Contractor.
    5. All subcontractors involved in removals, remediation, preparation, or installation of flooring in work areas.
C. The following constitutes mandatory discussion items that can be expanded per Project needs:
    1. Finalize construction schedule and ensure availability of materials, installer's personnel, equipment, and facilities needed to avoid delays. Required Concrete Testing shall be major item of consideration in Schedule, as successful installation of flooring material, depends on proper testing and assessment of test results.
    2. Review existing flooring material removal procedures and Owner notifications.
    3. Review requirements of section 09 0561 - Common Work Results for Flooring Preparation.
    4. Ensure substrate conditions and finishes are in compliance with requirements, including flatness and cleanliness.
        a. Start of flooring Work constitutes acceptance of surfaces to be covered and contractors adherence to the criteria contained in this specification.
    5. Finalize "On Site Storage" arrangements for flooring materials.
    6. Cover temporary protection requirements for flooring system during and after installation.
    7. Review proposed methods and procedures related to flooring installation, including manufacturer's written instructions and reach agreement for their conformance. Ensure that 50-70 kilogram Roller is used on the Project.
    8. Outline flooring observation and repair procedures after installation.
    9. Set procedure for preserving the environmental conditions of the spaces where flooring installations shall take place.
    10. Stress that expectations for high quality installations based on; Excellent materials, testing, use of Certified Master Mechanics only, addition of underlayments when necessary, and on site supervision with complete understanding of importance of adherence to manufacturer's instructions.
    11. Review Mock-up requirements, and determine mock-up locations and review schedule.

1.05 SUBMITTALS

A. Submittals will not be reviewed untill all related flooring system submittals are received.
    1. Substrate Test Results
    2. Resilient Flooring & Base
        a. Moisture Mitigation, if required.

b. Remediation Floor Coating and Underlayment.
c. Adhesive Product Data& Installation Guides.
d. Floor Finish Product Data & Installation Guides.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Selection Samples: For each type where color selection is not indicated or proposed material varies from Basis-of-Design, provide two sets of color chips representing proposed manufacturer's full range of available colors, patterns, and textures.
1. Where product specific color, pattern, or texture is indicated, proposed products of other manufacturers must be available in adequately matching color, pattern, and texture, at the sole discretion of the Architect.
2. Where other non-basis-of-design manufacturers are listed without colors, they may be considered of like quality, but is not meant to imply that those manufacturer's offer adequately matching products for all types required.

D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Flooring Material: Furnish one box for every 50 or fraction thereof, of each type, color, and pattern of floor tile installed.
3. Extra Wall Base and Accessories: Not Less than 10 linear feet, or fraction thereof, of each type and color.

1.06 QUALITY ASSURANCE

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

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

1.07 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 65 degrees F and 90 degrees F.

D. Protect roll materials from damage by storing on end.

E. Do not double stack pallets.

1.08 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 65 degrees F.

1.09 WARRANTY

A. Manufacturer's Warranty: From date of substantial completion, provide manufacturer's standard form in which the resilient flooring and accessories will protected against defects in material and workmanship and conform to product specifications, provided installation, maintenance and use falls within the manufacturer's current written instructions.
1. Warranty Period:
a. Rubber Stair Treads: Five (5) Year Manufacturer's Warranty
b. VCT: Thirty (30) Year Manufacturer's Warranty

PART 2 PRODUCTS

2.01 TILE FLOORING

A. Vinyl Composition Tile: Homogeneous, with color extending throughout thickness.
1. Manufacturers:
a. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
2. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
3. Size: 12 by 12 inch.
4. Thickness: 0.125 inch.
5. Color: As indicated on drawings.

2.02 STAIR COVERING

A. Stair Treads with Integral Risers: Rubber; full height of riser, full width and depth of tread in one piece; tapered thickness.
1. Manufacturers:

a. Johnsonite, a Tarkett Company: www.johnsonite.com.
b. Roppe Corporation: www.roppe.com/#sle.
c. Nora Systems, Inc: www.nora.com. (Basis-of-Design)
d. Substitutions: See Section 01 6000 - Product Requirements.

2. Minimum Requirements: Comply with ASTM F2169, Type TS, rubber, vulcanized thermoset.
3. Smoke Density: Maximum 450, when tested in accordance with ASTM E662 or NFPA 258.
4. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
5. Nominal Thickness: 0.1875 inch.
6. Nosing: Square.
7. Tread Texture: Raised.
8. Color: To be selected by Architect from manufacturer's full range.
9. Landing Tile to match the resilient stair tread.

B. Stair Stringers: Full height in one piece and in maximum available lengths, matching treads in material and color.
1. Manufacturers: Same as Stair Tread and Integral Riser Manufacturer
2. Nominal Thickness: 0.080 inch.

C. Stair Accessories: Provide manufacutrer's standard accessories required for a complete installation:
1. Epoxy Stair Filler: Two component, solvent free, non-flammable, high-performance exposy that sets to a hard, permenant bond.
2. Stair Repair Accessories:
a. Metal Repair Stair Angle
3. Visually Impaired Strips: 2" Wide textured striping insert.

2.03 RESILIENT BASE

A. Resilient Base (RB): ASTM F1861, Type TS rubber, vulcanized thermoset.
1. Manufacturers:
a. Johnsonite, a Tarkett Company; Baseworks: www.johnsonite.com/#sle.
b. Roppe Corporation; Pinnacle: www.roppe.com/#sle.
c. Substitutions: See Section 01 6000 - Product Requirements.
2. Smoke Density: Maximum 450, when tested in accordance with ASTM E662 or NFPA 258.
3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
4. Style and Locations:
a. Style A, Straight: Provide in areas with carpet
b. Style B, Cove: Provide in areas with resilient flooring.
5. Height: 4 inch or 6 inch based on existing conditions in renovated spaces.
6. Thickness: 0.125 inch.
7. Finish: Satin.
8. Length: Roll.
9. Color: As indicated on drawings.

2.04 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
C. Adhesive: Subject to compliance with manufacturer's recommendations, provide the following :
1. Resilient Sheet and Tile Flooring:
a. Tarkett: 100 Clear Thin Spread Adhesive
b. Substitutions: Section 01 6000 - Product Requirements.
2. Resilient Base: Including Rubber Base and Vented Cove Base
a. Johnsonite, a Tarkett Company; Johnsonite 960 Cove Base Adhesive: www.johnsonite.com/#sle.
b. Johnsonite, a Tarkett Company; Johnsonite 946 Premium Contact Adhesive: www.johnsonite.com/#sle.
c. Roppe Corporation; WB-600: Acrylic Wall Base Adhesive: www.roppe.com/#sle.
d. Roppe Corporation; AW-510: Acrylic West-Set Adhesive: www.roppe.com/#sle.
e. Roppe Corporation; C-630: Water-Based Contact Adhesive: www.roppe.com/#sle.
f. Substitutions: Section 01 6000 - Product Requirements.

D. Moldings, Transition and Edge Strips: Same material as flooring.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that concrete sub-floor surfaces are ready for installation in accordance with section 09 0561 - Common Work Results for Flooring Preparation.

C. Verify that wall surfaces are clean, smooth, permamnently dry, structurally sound, and flat within the tolerances specified for that type of work, and are ready to receive resilient base.

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

3.02 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 09 0561 and manufacturer's recommendations.

B. Prepare wall substrates per manufacturer's recommendations, correcting deficencies encountered.

1. Fill cracks, voids, divots, grout lines and imperfections with a patch or filler suitable for the substrate, allowing for curing time prior to installing base.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation:

1. Spread only enough adhesive to permit installation of materials before initial set.
2. Fit joints and butt seams tightly.
3. Set flooring in place, press with heavy roller to attain full adhesion.

D. Where type of floor finish, pattern, or color are different on opposite sides of door without transition strip, terminate flooring under centerline of door.

E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

G. Install flooring in recessed floor access covers, maintaining floor pattern.

3.04 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.

3.05 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.06 INSTALLATION - STAIR COVERINGS

A. Install stair coverings in one piece for full width and depth of tread.

B. Install stringers configured tightly to stair profile.

C. Adhere over entire surface. Fit accurately and securely.

D. Adhere to risers

3.07 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions no sooner than 72 hours after installation.

C. Provide manufacturer's recommended initial maitenance procedure.

1. Verify proposed product(s) with Owner prior to application.

3.08 PROTECTION

A. Prevent all traffic for a minimum of 12-hours and rolling loads for 72-hours to allow the adhesive to cure.

B. Protect flooring from damage during construction operations and placement of equipment and fixtures using Masonite, plywood or a similar product, ensuring first that the flooring surface is free of all debris. Lay panels so that the edges form a butt joint and tape the joint to prevent both movement and debris entrapment underneath. Inspect immediately before covering and after removal.

C. Protect flooring from mars, marks, indentations, and other damage until final acceptance and turnover to Owner.

END OF SECTION

SECTION 09 6600 - REFINISHING OF TERRAZZO

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refinishing of terrazzo floors.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittal procedures, project meetings, progress schedules and documentation, reports, coordination.

1.03 REFERENCE STANDARDS

A. ANSI A326.3 - American National Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Flooring Materials; 2021.

B. NTMA (SPECS) - NTMA Terrazzo Specifications; current edition located at www.ntma.com.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for sealer; include printed copy of current NTMA recommendations for the type of terrazzo specified.

C. Installer's Qualification Statement.

D. Cleaning and Maintenance Data: Include procedures for stain removal, stripping, and sealing.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with NTMA recommendations as posted at their web site at www.ntma.com.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least ten years of documented experience , and currently holding Contractor Mamber status with NTMA.

1.06 MOCK-UP

A. Refinish 10 feet long by 10 feet wide area, illustrating appearance of completed work.

B. Locate where directed.

C. Approved mock-up may remain as part of the Work.

1.07 FIELD CONDITIONS

A. Provide ambient lighting level of 50 ft candles, measured at floor surface.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cleaner: Potable water, free of iron.

B. Sealer: Colorless, non-yellowing, waterbourne acrylic liquid type, chemically neutral with a pH factor between 7 to 10; not detrimental to terrazzo components.

1. Provide sealer listed as "slip resistant" or similar, with a Dynamic Coefficient of Friction of 0.50 (wet), minimum when tested in accordance with ANSI A326.3.

2.02 EQUIPMENT

A. All grinding shall be executed with conventional terrazzo grinding equipment according to trade practice. No lighter type machines, such as floor scrubbing machines, will be accepted.

PART 3 EXECUTION

3.01 PREPARATION

A. Cover and protect all adjacent finished surfaces during refinishing process.

B. Where refinishing is indicated to stop adjacent to other floor surfaces, including terrazzo, place barrier or otherwise protect existing flooring from refinishing operations. select nearest logical point of termination, such as terrazzo strip or control joint. Verify selected boundry with Owner's Representative prior to starting refinishing operations.

C. Strip floors that have been waxed.

D. Scrub floors to remove dirt and foreign materials prior to grinding.

3.02 FINE GRINDING

A. After floors have been sufficiently cleaned, grind using a fine grit abrasive.
   1. Final Grind to 200+ grit diamond abrasive or equal.
   2. Delay fine grinding until heavy trade work is complete and construction traffic through area may be restricted.
   3. Coordinate final grinding with final grinding of adjacent newly installed terrazzo.

3.03 CLEANING AND SEALING

A. Rinse with clean water and allow to thoroughly dry.

B. Apply sealer, per manufacturer's directions.

C. Remove protection and clean any adjacent surfaces effected by the refinishing process.

3.04 PROTECTION

A. Protect floors from damage due to subsequent construction until Date of Substantial Completion. .

END OF SECTION

SECTION 09 6623 - RESINOUS MATRIX TERRAZZO FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Epoxy matrix terrazzo with ground and polished finish.
B. Divider strips.
C. Precast epoxy terrazzo wall base.
D. Precast epoxy terrazzo stair units.

1.02 RELATED REQUIREMENTS

A. Section 09 0561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.
B. Section 09 6600 - Refinishing of Terrazzo.

1.03 REFERENCE STANDARDS

A. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2013 (Revised).
B. ANSI A326.3 - American National Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Flooring Materials; 2021.
C. ASTM C131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine; 2014.
D. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2014.
E. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2014.
F. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics; 2010.
G. ASTM D696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between - 30 C and 30 C with a Vitreous Silica Dilatometer; 2016.
H. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials; 2016.
I. ASTM D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes; 2002 (Reapproved 2013).
J. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2005 (Reapproved 2010).
K. NTMA (EPOXY) - Epoxy Terrazzo Specifications; The National Terrazzo and Mosaic Association, Inc.; Current Edition located at www.ntma.com.
L. NTMA (GRAD) - Aggregate Gradation Standards; The National Terrazzo and Mosaic Association, Inc.; current edition.

1.04 SUBMITTALS

A. Product Data: Provide data for divider strips, control joint strips, expansion joints, and sealer; include printed copy of current NTMA recommendations for type of terrazzo specified. System will be evaluated on the basis of standards. For tests not listed in published data, manufacturer shall supply missing data according to standard reference
    1. Physical Properties
    2. Performance properties
    3. Specified Tests
    4. Material Safety Data Sheet
    5. Manufacturer's standard warranty
B. Shop Drawings: Indicate divider strip and control and expansion joint layout, and details of adjacent components. For precast units, detail profile and anchorage requirements.
C. Samples: Submit two samples, 6 inch by 6 inch in size illustrating color, chip size and variation, chip gradation, matrix color, and typical divider strip.
    1. Assume up to five (5) sample iterations of each color/mix design.
    2. Mix Design Indicated: Where mix design is indicated produce sample based on mix design.
    3. Matching Existing: Where indicated Contractor shall produce samples to match existing in all aspects.

a. Existing material shall be cleaned, stripped of waxes and sealers, and polished prior to matching.
b. Where scope allows for removal of existing material contractor shall cafefully remove and send existing material sample to manufacturer for matching.
c. Where scope does not allow for removal of existing material contractor shall locate an area of existing material to clean, strip, and polish for use in producing field matched sample. Coordinate location with Owner's Representative.

D. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports per Section 09 0561 - Common Work Results for Flooring Preparation.
E. Manufacturer's Qualification Statement.
F. Installer's Qualification Statement.
G. Cleaning and Maintenance Data: Include procedures for stain removal, stripping, and sealing.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with NTMA recommendations as posted at their web site at www.ntma.com.
B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section.
1. Minimum ten years of documented experience.
2. Associate Member firm of the National Terrazzo and Mosaic Association, Inc.
C. Installer Qualifications: Company specializing in performing the type of work specified in this section.
1. Minimum ten years of documented experience.
2. Approved by matrix manufacturer.
3. Contractor Member of the National Terrazzo and Mosaic Association, Inc.
D. Source Limitations:
1. Obtain primary Epoxy Terrazzo Flooring System materials including membranes, primers, moisture vapor primers, resins and hardening agents from a single manufacturer with proof of NTMA membership.
E. Pre-installation Conference: Conduct conference at Project site to comply with requirements in specifications. Review methods and procedures related to terrazzo including, but not limited to, the following:
1. Inspect and discuss installation procedures, joint details, jobsite conditions, substrate specification, vapor barrier details and coordination with other trades.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment and facilities needed to make progress and avoid delays.
3. Review special terrazzo designs and patterns.
4. Review dust control procedures.
5. Review plans for concrete curing and site drying to enable timely achievement of suitable slab moisture conditions.

1.06 MOCK-UP

A. Construct mock-up of terrazzo illustrating appearance of finished work in each configuration required. Size mock-up to be not less than 10 by 10 feet.
B. Locate where directed.
1. One (1) Mockup new door alcove in Music Wing.
C. Approved Mock-up may remain as part of the work if undisturbed at time of Substantial Completion.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store terrazzo materials in a dry, secure area.
B. Maintain minimum temperature of 60 degrees F.
C. Keep products away from fire or open flame.

1.08 FIELD CONDITIONS

A. Terrazzo contractor shall, prior to surface preparation:
1. Evaluate slab condition, including slab moisture content and extent of repairs required, if any.
2. Test concrete substrate in accordance to 09 0561 - Common Work Results for Flooring Preparation.
B. Do not install terrazzo when temperature is below 50 degrees F or above 90 degrees F.
C. Maintain temperature within specified range 24 hours before, during, and 72 hours after installation of flooring.
D. Concrete to receive epoxy terrazzo shall have cured for at least 28 days and be free of all curing compounds.
E. Prior to and during each day of installation, the terrazzo contractor shall verify that the dew point is at least 5 degree F less than the slab and air temperature.

F. Acceptable Substrates:
1. Flatness tolerance: Concrete sub-floor shall be level with a maximum variation from level of 1/4" int 10 feet. Any irregularity of the surface requiring patching and/or leveling shall be done using Terroxy Fill and selected aggregates as recommended by Terroxy Resin Systems.
2. Concrete floor shall be prepared mechanically by shot blasting or by grinding with Wolverine Scarifying Diamonds in accordance with ICRI Guideline No. 03732. Specifically, surface preparation results should achieve a CSP3-CSP5 profile
3. Concrete shall be cured a minimum of 28 days. No curing agents are to be used in areas to receive terrazzo.
4. Concrete slab shall have an efficient moisture vapor barrier (suggested minimum: fiber reinforced 15 mils thickness) directly under the concrete slab. Moisture barrier shall not be punctured and shall be sealed with a vapor barrier grade flashing tape at all terminations, penetrations ans seams.
5. Saw cutting of control joints must be done between 12 and 24 hours after placement of the structural concrete and at a frequency and depth compatible to ACI recommendations

G. Provide ambient lighting level of 50 ft candles, measured at floor surface.

1.09 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard form in which the terrazzo matrix will be free of manufacturing defects and will confrim to published specification when handled, stored, mixed and applied in accordance to recommendations of NTMA.
1. Warranty Period: One (1) year from delivery of materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Resinous Matrix Terrazzo Flooring:
1. Key Resin Company: www.keyresin.com.
2. Sherwin-Williams Company: General Polymers Brand: www.generalpolymers.com/#sle.
3. Terrazzco; TERRAZZCO Epoxy Terrazzo System, a brand of Concord Terrazzo Company, Inc: www.terrazzco.com/#sle.
4. Terrazzo & Marble Supply Companies; Terroxy Resin Systems: www.tmsupply.com. (Basis-of-Design)
5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 EPOXY MATRIX TERRAZZO APPLICATIONS

A. Floors:
1. Thickness: 3/8 inch, nominal.
2. Color(s): As indicated on drawings.
3. Aggregate Type: Marble chips.
4. Aggregate Size: Conform with NTMA gradation standards, No. 1 and 2.

B. Precast Stairs - Treads, Risers, and Landings: Precast epoxy terrazzo.
1. Basis of Design; TERRAZZCO Epoxy Terrazzo System: Precast Terrazzo Tread PTZ-TR-2
2. Thickness: 1-1/2 inch, minimum.
3. Color(s): Same as adjacent floor.

2.03 MATERIALS

A. Epoxy Matrix Terrazzo: Aggregate and matrix mix applied to substrate, troweled flat, and ground smooth.
1. Mix Proportions: As required to achieve appearance specified.

B. Matrix: Two component resin and epoxy hardener with mineral filler and color pigment, non-volatile, thermo-setting.
1. Physical properties without aggregates. All specimens cured for 7 days at 75 degrees F and 50 percent RH, shall meet the following requirements as set forth by the NTMA:
a. Hardness: 60-85 Shore-D durometer per ASTM D2240.
b. Tensile Strength: 3,000 psi minimum per ASTM D638.
c. Compressive Strength: 10,000 psi minimum per ASTM D695.
d. Flexural Strength: 4,000 psi minimum per ASTM D790.
e. Chemical Resistance: No deleterious effects after seven days immersion at room temperature per ASTM D1308.
1) Distilled Water.
2) Mineral Water.
3) Isopropanol.
4) Ethanol.
5) Soap solution at 1 percent.

6) Sodium hydroxide at 10 percent solution.
7) Hydrochloric acid at 10 percent solution.
8) Hydrochloric acid at 30 percent solution.
9) Detergent Solution at 0.025.
10) Acetic Acid at 5 percent solution.

2. Physical properties with aggregates. For Epoxy Matrix, blended chips, ground and grouted with epoxy resin according to Installation Specifications, finishing to a nominal 3/8" thickness. All specimens cured for 7 days at 75 degrees F and 50 percent RH, shall meet the following requirements as set forth by the NTMA:
   a. Flamability: Self-extinguishing, extent of burning not to exceed 0.025 inches, per ASTM D635.
   b. Thermal Coefficient of Linera Expansion: 25x10^-6 inches per inch per degrees to 140ºF, per ASTM D696.
   c. Bond Strength: 300 psi minimum per ACI COMM 403, Bulletin 59-43 (pages 1139-1141).

C. Aggregate: Type as indicated; sized in accordance with NTMA aggregate gradation standards; color(s) as indicated, uniform in color and containing no deleterious or foreign matter. Selection of aggregates to be from Specified Manufacturer's Marble Chips, specialty aggregates, glass aggregates and resin aggregates to match architects samples.
   1. Physical Properties:
      a. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C131.
      b. 24-Hour Absorption Rate: Less than 0.74 percent.
      c. Dust Content: Less than 1.0 percent by weight.

D. Finishing Grout: Epoxy, color to match terrazzo matrix.
   1. Products:
      a. Terrazzo & Marble Supply Companies; Terroxy Epoxy Matrix: www.tmsupply.com. (Basis-of-Design)
      b. Key Resin Company: www.keyresin.com.
      c. Sherwin-Williams Company: General Polymers Brand: www.generalpolymers.com/#sle.

E. Precast Epoxy Terrazzo Units: Fabricate to sizes and profiles indicated on drawings.
   1. Setting Material: Epoxy adhesive, ANSI A118.3.

2.04 ACCESSORIES

A. Divider Strips: 1/8 inch thick zinc exposed top strip, zinc coated steel concealed bottom strip, with anchoring features.

B. Control Joint Strips: 1/8 inch nominal width zinc exposed top strips, zinc coated steel concealed bottom strips, 1/8 inch wide neoprene filler strip between vertical strips, with anchoring features.

C. Divider and Control Joint Strip Height: To suit thickness of terrazzo topping, with allowance for grinding.

D. Non-Slip Inserts: Provide channel-shaped inserts filled with a mixture of resin and fine, abrasive aggregate, installed perpendicular to the path of travel, unless otherwise indicated.
   1. Width: 1/2 inch.
   2. Depth: As required by terrazzo thickness.
   3. Length: 4 inches less than ramp/stair width.
   4. Color: Black.

E. Anchors and Reinforcement for Precast Units: As recommended by manufacturer for type of installation.

F. Sealer: Manufacturer's recommended Colorless, non-yellowing, waterbourne acrylic liquid type, chemically neutral with a pH factor between 7 and 10; not detrimental to terrazzo components.
   1. Provide sealer listed as "slip resistant" or similar, with a Dynamic Coefficient of Friction of 0.50 (wet), minimum when tested in accordance with ANSI A326.3.

G. Primer: Epoxy resin.
   1. Products:
      a. Terrazzo & Marble Supply Companies; Terroxy Primer: www.tmsupply.com. (Basis-of-Design)
      b. Key Resin Company: www.keyresin.com.
      c. Sherwin-Williams Company: General Polymers Brand: www.generalpolymers.com/#sle.

H. Flexible Reinforcing Membrane: For control joints, cold joints, and substrate crack preparation and reflected crack reduction as noted within this specification.
   1. Reinforcement: Fiberglass scrim.
   2. Install on up to 15% of slab to receive epoxy terrazzo, as recommended by manufacturer.
   3. Products:
      a. Terrazzo & Marble Supply Companies; Terroxy Iso-Crack Epoxy Membrane: www.tmsupply.com. (Basis-of-Design)
      b. Key Resin Company: www.keyresin.com.

c. Sherwin-Williams Company: General Polymers Brand: www.generalpolymers.com/#sle.

I. Patching and Fill Material; selected by architect to match/compliment terrazzo.
   1. Products:
      a. Terrazzo & Marble Supply Companies; Terroxy Fill: www.tmsupply.com. (Basis-of-Design)
      b. Key Resin Company: www.keyresin.com.
      c. Sherwin-Williams Company: General Polymers Brand: www.generalpolymers.com/#sle.

J. Cleaner: A neutral cleaner with pH factor between 7 and 10 specifically designed for Terrazzo.
   1. Products:
      a. Terrazzo & Marble Supply Companies; Terroxy Terra Clean: www.tmsupply.com. (Basis-of-Design)
      b. Key Resin Company: www.keyresin.com.
      c. Sherwin-Williams Company: General Polymers Brand: www.generalpolymers.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive terrazzo.

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

C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for terrazzo flooring installation by testing for moisture and alkalinity (pH).
   1. Test in accordance with Section 09 0561.
   2. Obtain instructions if test results are not within limits recommended by terrazzo flooring manufacturer.
   3. Follow moisture and alkalinity remediation procedures in Section 09 0561.

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

F. Proceed with installation only after unsatisfactory conditions, including level tolerances, have been corrected.

3.02 PREPARATION

A. Protect other work from dust generated by grinding operations. Control dust to prevent air pollution and comply with environmental protection regulations.
   1. Erect and maintain temporary enclosures and other suitable methods to limit dust migration and to ensure adequate ambient temperatures and ventilation conditions.

B. Clean substrate of foreign matter.

C. Prepare concrete subfloor by mechanically abrading surface in accordance with manufacturer's instructions and the following:
   1. Provide sound concrete surface free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil and other contaminants incompatible with terrazzo.

D. Repair cracks and non-expansion joints greater than 1/16 inches wide according to manufacturer's requirements.
   1. Provide up to 100 lineal feet of crack repair.

E. Apply primer in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Install terrazzo and accessories to NTMA requirements.

B. Saw cut substrate where required to install divider and control joint strips.

C. Install control joint strips straight and flat to locations indicated.
   1. All isolation and control joints from the slab need to be honored in the terrazzo.

D. Install divider strips according to pattern approved on shop drawings and the following:
   1. Install strips in adhesive setting bed without voids below strips or mechanically anchor strips as required to attach strips to substrate.
   2. Control-Joint Strips: Separate double L-type angles, positioned back to back with minimum 1/8”-1/4” width between. (Single L-type angle, positioned adjacent to the joint is also acceptable.) Fill joint and area between strips with semi-flexible Terroxy Joint Filler. Match material, thickness and color of divider strips and depth required for topping thickness indicated.
   3. Construction-Joint (Cold-Joint) Strips: Separate double L-type angles, positioned back to back with minimum 1/8”-1/4” width between. Fill joint and area between strips with semi-flexible Terroxy Joint Filler. Match material, thickness and color of divider strips and depth required for topping thickness indicated.
   4. Expansion-Joint Strips: Separate double L-type angles, positioned back to back with minimum 1/8”-1/4” width between. Fill area between strips with semi-flexible Terroxy Joint Filler. Match material, thickness and color of divider strips and depth required for topping thickness indicated.

5. Accessory Strips, Color Separations Strips: Separate colors of terrazzo following the patterns noted on the drawings.

E. Install non-slip inserts in floors and stair treads where indicated.

F. Place terrazzo mix over substrate to thickness indicated.
   1. Mix epoxy matrix with chips and fillers in ratios directed by the manufacturer.
   2. Trowel apply terrazzo mixture over epoxy primer to provide a dense flat surface to top of divider strips. Allow to cure per manufacturer's recommendations before rough grinding.

G. Anchor precast units as indicated on drawings.

H. Install precast units using specified setting material.

I. Seal joints between precast units with joint sealants.

3.04 FINISHING

A. Finish terrazzo to NTMA requirements.

B. Produce terrazzo finish surface to match approved sample, with 70 percent chip exposed.

C. Rough Grinding: Grind with 24 or finer grit stones or with comparable diamond abrasives, followed by 60/80 grit stones or with comparable diamond abrasives.

D. Grind terrazzo surfaces with power disc machine; sequence with coarse to fine grit abrasive, using a wet method or using a dry grinder with vacuum to control dust.

E. Apply grout to fill voids exposed from grinding, per manufacturer's recommendations.

F. Remove grout coat by grinding using a fine grit abrasive.
   1. Final Grind to 200+ grit diamond abrasive or equal.
   2. Delay fine grinding until heavy trade work is complete and construction traffic through area may be restricted.
   3. Coordinate final grinding with grinding/restoration of adjacent terrazzo where indicated.

G. Hand grind vertical and curved surfaces to match floor surface unless noted otherwise.

3.05 TOLERANCES

A. Maximum Variation from Flat Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Level (Except Surfaces Sloping to Drain): 1/8 inch.

3.06 CLEANING

A. Scrub and clean terrazzo surfaces with neutral pH cleaner in accordance with manufacturer's instructions. Let dry.

B. Immediately after terrazzo has dried, apply sealer in accordance with manufacturer's instructions.

C. Polish surfaces in accordance with manufacturer's instructions.

3.07 PROTECTION

A. Protect finished terrazzo from damage due to subsequent construction until Date of Substantial Completion.

END OF SECTION

PART 1 – GENERAL

1.01 Section Includes

A. Sprayed cellulose thermal insulation. (07 21 29)
B. Sprayed cellulose acoustical insulation. (09 83 16)

1.02 Related Items

A. Clips, hangers, supports, sleeves and other attachments to spray bases are to be placed by other trades prior to the application of sprayed insulation.
B. Ducts, piping, conduit or other suspended equipment shall not be positioned until after the application of sprayed insulation.
C. Roof penetrations to be installed prior to application.

1.03 Quality Assurance

A. Manufacturer must have a current Underwriters Laboratories (UL) Code Evaluation Report.
B. Manufacturer must be in compliance with the 2009-2021 International Building Code.
C. Manufacturer must be ISO 9001:2015 Certified.
D. Applicator: Licensed by manufacturer.
E. Manufacturer must subscribe to independent laboratory follow-up inspection services of Underwriters Laboratories and Factory Mutual. Each bag shall be labeled accordingly.
F. Mock-up: Apply a 100 square foot representative sample to be reviewed by the Architect and/or Owner prior to proceeding.
G. Manufacturer shall have a minimum 10-year successful performance history of producing and installing spray-applied cellulose on similar projects
H. Material must be tested in accordance with ASTM E 1042 by a NVLAP accredited testing laboratory.

1.04 Submittals

A. Submit product data that the product meets or exceeds the following specified requirements.
1. Bond strength shall be greater than 150 psf per ASTM E 736.
2. Product shall be Class 1 Class A per ASTM E 84/ UL 723.
3. Non-corrosive per ASTM C 1149
4. Bond Deflection per ASTM E 759: 6" Deflection in 10' Span – No Spalling or Delamination.
5. R-Value to be 3.70 per inch per ASTM C 518.
6. Comply with 2015 IBC Section 803.12 stability requirements for interior finishes.
7. Meet ASTM C 1149
8. Product shall be Cradle to Cradle® Certified v.3.1 or higher to a minimum certification level of Bronze
9. Product shall be UL GREENGUARD Gold Certified
10. Product must have a publicly available Health Product Declaration (HPD) to 100 PPM
11. Product must have a third-party verified, publicly available, product-specific Environmental Product Declaration per ISO 14025
12. Manufacturer's written certification that product contains no asbestos, fiberglass or other man-made mineral fibers.
13. Copy of manufacturer's ISO 9001:2015 Certification.
14. Minimum Fiber Recycled Content to be 80%.
15. Cannot contain any added Urea-Formaldehyde Resins.

1.06 Delivery, Storage and Handling

A. Deliver in original, unopened containers bearing name of manufacturer, product identification and reference to U.L. testing.
B. Store materials dry, off ground, and under cover.
C. Protect liquid adhesive from freezing.
D. Water to be potable.

PART 2 – PRODUCTS

2.01 Acceptable Manufacturers

A. International Cellulose Corporation 12315 Robin Boulevard

Houston, Texas 77045
Phone: (713) 433-6701 or (800) 444-1252
Fax: (713) 433-2029
Website: www.spray-on.com Email: icc@saint-gobain.com

B. For approved applicators contact ICC at (800) 444-1252.

2.02 Materials

A. K-13 Spray-On-Systems.
   1. Color shall be black
   2. Each bag must be labeled with appropriate UL classification and FM markings
   3. Each drum of adhesive must be labeled "SK-2000 adhesive to be used with K-13"

PART 3 – EXECUTION

3.01 Examination

A. Examine surfaces and report unsatisfactory conditions in writing. Do not proceed until unsatisfactory conditions are corrected.
B. Verify surfaces to receive spray insulation to determine if priming/sealing is required to insure bonding and/or to prevent discoloration caused by migratory stains.

3.02 Preparation

A. Provide masking, drop cloths or other satisfactory coverings for materials/surfaces that are not to receive insulation to protect from over-spray.
B. Coordinate installation of the sprayed cellulose fiber with work of other trades.
C. Prime surfaces as required by manufacturer's instructions or as determined by examination.
D. Prime all gypsum board surfaces with high quality, commercial, gypsum board primer

3.03 Installation

A. Install spray applied insulation according to manufacturer's recommendations.
B. Comply with local Building Code requirements.
C. Install spray applied insulation to achieve an average R-Value of _____.
D. Install spray applied insulation to achieve an average NRC of _____.

K-13 Sprayed Thermal and Acoustical Insulation on Solid Backing:		
Thickness:	**NRC:**	**R-Value:**
1.00"	0.80	3.70
1.50"	0.90	5.60
1.75"	1.00	6.50
2.00"	1.00	7.40
3.00"	1.00	11.10
4.00"	1.05	14.80
5.00"	1.00	18.50
K-13 Sprayed Thermal and Acoustical Insulation on 1.50" Metal Deck:		
Thickness:	**NRC:**	**R-Value:**
1.50"	1.05	5.60
3.00"	1.05	11.10
K-13 Sprayed Thermal and Acoustical Insulation on 2" Metal Deck:		

Thickness:	NRC:	R-Value:
1.00”	0.90	3.70
2.00”	1.05	7.40
K-13 Sprayed Thermal and Acoustical Insulation on 3” Metal Deck:		
Thickness:	**NRC:**	**R-Value:**
1.00”	0.95	3.70
1.50”	1.00	5.60
2.75”	1.05	10.20

E. Cure insulation with continuous natural or mechanical ventilation.
   a. Continuous ventilation must be maintained until the material has properly cured.
F. Remove and dispose of over-spray.

4.01 Protection

A. Protect finished installation under provision of Division 1.

END OF SECTION 09 8316

SECTION 09 8430 - SOUND-ABSORBING WALL AND CEILING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sound-absorbing wall panels.
B. Sound-absorbing ceiling panels.
C. Mounting accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 5100 - Acoustical Ceilings: Ceiling suspension system.

1.03 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2009a.
B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
C. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests; 2005 (Reapproved 2012).

1.04 SUBMITTALS

A. Product Data: Manufacturer's printed data sheets for products specified.
B. Shop Drawings: Fabrication and installation details, panel layout, fabric orientation, and wood grain orientation.
C. Selection Samples - Fabric: Manufacturer's color charts for fabric covering, indicating full range of fabrics, colors, and patterns available.
D. Selection Samples - Wood Veneer: Manufacturer's color charts for wood veneer including full range of colors and fnishes.
E. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch, showing construction, edge details, and fabric covering.
F. Manufacturer's qualification statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company with not less than five years of experience in manufacturing acoustical products similar to those specified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.
B. Store units flat, in dry, well-ventilated space; do not stand on end.
C. Protect edges from damage.

PART 2 PRODUCTS

2.01 FABRIC-COVERED SOUND-ABSORBING UNITS

A. Manufacturers:
   1. RPG Acoustical Systems, Inc;[Absorbor Hi-Impact]: www.rpgacoustic.com/#sle. (BASIS OF DESIGN)
      a. Fabric: Guilford of Maine (BASIS OF DESIGN)
   2. LAMVIN; Sonic Standard Panel: www.lamvin.com/#sle.
   3. TECHLITE; Accent Fabric Wrapped Panels: www.techlite.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.
B. General:
   1. Prefinished, factory assembled fabric-covered panels.
   2. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
C. Fabric-Covered Acoustical Panels for Walls:
   1. Panel Core: Manufacturer's standard semi-rigid fiberglass core.
   2. Panel Size: As noted on drawings
   3. Panel Thickness: 2 inches.
   4. Edges: Perimeter edges reinforced by a formulated resin hardener.

5. Corners: Square.
6. Fabric: Woven polyester.
7. Color: As selected by Architect from manufacturer's full range.
8. Patterns: Where fabric with directional or repeating patterns or fabric with directional weave is used, mark for installation in same direction.
9. Mounting Method: Back-mounted with mechanical fasteners.

2.02 WOOD VENEER SOUND-ABSORBING UNITS

A. Manufacturers:
1. Rulon International; Curvalon Perforated Wood Veneer Ceiling and Supension system, pattern A750:rulonco.com. (BASIS OF DESIGN)
2. Rulon International; Curvatone Wood Veneer Ceiling and Supension system, 7X0 Microperf, pattern A750:rulonco.com. (BASIS OF DESIGN)
3. Rulon International; Aluratone Grooved Wood Veneer Wall Panel, pattern 900:rulonco.com. (BASIS OF DESIGN)
4. Murano Acoustics USA, by Bartley Group, Inc; Murano Acoustics Grooved Acoustic Wood Panels, pattern G8: www.muranoacousticsusa.com/#sle.
5. Murano Acoustics USA, by Bartley Group, Inc; Murano Acoustics Perforated Acoustic Wood Panels, pattern P316: www.muranoacousticsusa.com/#sle.
6. RPG Acoustical Systems, Inc; Expo: www.rpgacoustic.com/#sle.
7. Substitutions: See Section 01 6000 - Product Requirements.

B. Wood Veneer Acoustical Panels for Ceilings: Medium Density Fiberboard (MDF) core panels with prime grade finished face veneer and non-woven acoustical fabric adhered to back of panel.
1. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
2. Sound Absorption: Noise Reduction Coefficient (NRC) or Sound Absorption Average (SAA) of 0.80 to 0.95 when tested in accordance with ASTM C423 for Type A mounting, perASTM E795.
3. Acoustic Back-Up Material: Compressed fiberglass board, [0.75 lbs/ft] lbs/cu ft density, in sizes to fit furring applications.
   a. Thickness: 2 inch.
4. Panel Size: As per Drawings
5. Front Panel Thickness: 3/4 inch.
6. Panel Weight: 1.29 psf.
7. Surface Veneer Species: Red Oak.
8. Perforated Panel: Patter A750.

C. Wood Veneer Acoustical Panels for Walls: Medium Density Fiberboard (MDF) core panels with prime grade finished face veneer and non-woven acoustical fabric adhered to back of panel.
1. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
2. Sound Absorption: Noise Reduction Coefficient (NRC) or Sound Absorption Average (SAA) of 0.70 to 0.80 when tested in accordance with ASTM C423 for Type A mounting, per ASTM E795.
3. Acoustic Back-Up Material: Compressed fiberglass board, 0.75 lbs/ft lbs/cu ft density, in sizes to fit furring applications.
   a. Thickness: 2 inch.
4. Panel Size: As per Drawings
5. Panel Thickness: 3/4 inch.
6. Panel Weight: 1.29 psf.
7. Surface Veneer Species: Red Oak.
   a. Grain Direction: Flat.
8. Grooved Panel: Pattern 900 .
   a. Groove Width: 0.078 inch, nominal.
   b. Spacing: 0.393 inch
9. Mounting: Use fixing clips to attach to metal hat channels anchored to wall substrate.
   a. Edge Profile: Reveal.

2.03 FABRICATION

A. Fabric Wrapped, General: Fabricate panels to sizes and configurations as indicated, with fabric facing installed without sagging, wrinkles, blisters, or visible seams.

B. Veneer Wood Panel, General: Fabricate to sizes as indacted

C. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch for thickness, overall length and width, and squareness from corner to corner.

D. Factory-applied finishes on wood veneer panels to be uniform, smooth, and without blemishes.

2.04 ACCESSORIES

A. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal, and as follows:

1. Mechanically Mounted Metal-Framed Panels: Metal panel-clip system designed to engage metal framing of panels.

B. Ceiling-Suspended Accessories: Manufacturer's standard accessories at locations as indicated on each acoustical unit, sized appropriately for weight of acoustical unit.

C. Fixing Clips: Manufacturers standard for application as indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Do not begin installation until substrates have been properly prepared.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and in proper relationship with adjacent construction, including the following: Comply with ASTM C 636 and seismic design requirements indicated.

B. Suspend panels from the z-clips as indicated.

C. Install mounting accessories and supports in accordance with shop drawings.

D. Make final adjustments to level or contours as required.

3.03 CLEANING

A. Clean fabric facing upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

B. Clean exposed surfaces of wall panels in accordance with manufacturer's instructions.

C. Remove and replace panels and tiles, which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.04 PROTECTION

A. Provide protection of installed acoustical panels until Date of Substantial Completion.

B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

END OF SECTION

SECTION 09 9113 - EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.
B. Field application of paints.
C. Scope: Apply Exterior Paints/Stains only where noted in drawings.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting & Transparent Finishing.

1.03 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.
B. MPI Manual: the “Master Painters Institute Architectural Painting Specification Manual”, current edition.
C. MPI Repainting Manual: the “Master Painters Institute Maintenance and Repainting Manual”, current edition.
D. DSD: Degree of Surface Degradation, as defined by MPI. It shall be the basis of evaluating surfaces for required preparation.
E. Gloss Levels indicated in this section follow the MPI Manual. Traditional gloss levels are included below for reference only.

MPI	Traditional	Gloss @ 60° (ASTM D523)	Sheen @ 85° (ASTM D523)
G1	Matte / Flat	5 maximum	10 maximum
G2	Velvet-like Flat, Eggshell	10 maximum	10-35
G3	Eggshell	10-25	10-35
G4	Satin	20-35	35+
G5	Semi-gloss	35-70	
G6	Gloss	70-85	
G7	High Gloss	85+	

1. Please note that some manufacturers' terms for traditional gloss levels may not coincide with the table above.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2014.
C. ASTM D523 - Standard Test Method for Specular Gloss; 2014.
D. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.
E. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; current edition, www.paintinfo.com.
F. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
G. SSPC-SP 1 - Solvent Cleaning; 2015.
H. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).
I. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.05 SUBMITTALS

A. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "acrylic latex").
   2. MPI product number (e.g. MPI #47).
   3. Manufacturer's installation instructions.
B. System Description Letter: on installer's letterhead for each system proposed, including:
   1. Substrate(s).
   2. MPI System designation, where applicable.
   3. Assessment of existing surface condition(s).
      a. Use MPI's DSD designations.

4. Proposed surface preparation(s).
    a. Existing finished surfaces: Reference MPI Repainting Manual surface preparation procedure numbers.
    b. New, or existing unfinished surfaces: Reference MPI Manual surface preparation procedure numbers.
    c. Where proposed method fails to adequately prepare surface, additional preparation up to and including the most stringent methods appropriate may be required, at no additional cost to the Owner.
5. List of products to be applied in order from substrate to final coat, including preparation required between coats.

C. Reference Materials: Provide proof of ownership or on-line access to MPI and SSPC Manuals listed in Definitions above.

D. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
1. Where sheen is specified, submit samples in only that sheen.
2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
3. Allow 30 days for approval process, after receipt of complete samples by Architect.
4. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as Exterior Metals, have been approved.

E. Manufacturer's Instructions: Indicate special surface preparation procedures and substrate conditions requiring special attention.

F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
3. Label each container with color in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

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

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years documented experience.

1.07 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.09 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface, but not less than 30 ft candles over surface to receive finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
1. If a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
2. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.

3. Substitution of a different paint system using MPI-approved products by the same manufacturer will be considered.
4. Alternative products listed by MPI in the same category as specified products does not constitute an "equal" under this specification.

B. Paints:
1. Benjamin Moore: www.benjaminmoore.com
2. Pittsburgh Paints: www.ppgpaints.com/#sle.
3. Sherwin-Williams Company: www.sherwin-williams.com. (Basis-of-Design for Color Selections)

C. Primer Sealers: Same manufacturer as top coats.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
4. Supply each paint material in quantity required to complete entire project's work from a single production run.
5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
1) Opaque, Flat: 50 g/L, maximum.
2) Opaque, Nonflat: 150 g/L, maximum.
3) Opaque, High Gloss: 250 g/L, maximum.
c. Architectural coatings VOC limits of NY State.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: To be selected from manufacturer's full range of available colors.
1. Selection to be made by Architect after award of contract.
2. Extend colors to surface edges; colors may change at any edge as directed by Architect.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Exterior Plaster and Stucco: 12 percent.
2. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to evaluation.

B. This section outlines minimum preparation guidelines for various substrates, but it is the responsibility of the Contractor to evaluate and prepare surfaces using recommended methods and guidelines per reviewed submittals, industry standards, manufacturer's recommendations, and MPI publications for achieving the best result for each substrate under the project conditions.
1. Contractor shall evaluate condition of surfaces using MPI's DSD rating system.

2. Unless otherwise indicated, Contractors may start with least agressive MPI recommended method they deem appropriate to conditions.
3. Where initial method fails to adequately prepare surface, additional preparation up to and including the most stringent methods appropriate may be required, at no additional cost to the Owner.

C. Remove or repair existing paints or finishes that exhibit surface defects.

D. Remove surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Galvanized Surfaces:
1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
2. Prepare surface according to SSPC-SP 2.

H. Ferrous Metal:
1. Solvent clean according to SSPC-SP 1.
2. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

3.03 APPLICATION

A. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

3.06 SCHEDULE - MPI SYSTEMS

A. Substrate: Steel and Other Ferrous Metals, Exterior.
1. Industrial Duty: Polyurethane over Zinc Rich Primer and High-Build Epoxy, MPI System EXT 5.1G / REX 5.1MM. For use at _____ .
a. Prep (new surfaces): as recommended by MPI EXT 5.1.
b. Existing Surface/Finish Condition: Varies, Assume for Bidding at least DSD-3 (Severely Deteriorated).
c. Prep (existing previously finished surfaces): as recommended by MPI for surface condition, but not less than MPI RSP-7b (Abrasive Blast Cleaning - Metals).
1) Reference: SSPC-SP 6 (Commercial Blast Cleaning),
d. Primer: Zinc Rich, Inorganic, MPI #20.
1) Benjamin Moore (does not manufacture an acceptable product in this category)
2) PPG Aquapon Zinc Rich Epoxy, 97-670 Series.
3) Sherwin-Williams Protective & Marine Zinc Clad IV, B69A8/B69V8.
e. 1st Finish Coat: Epoxy, High Build, Low Gloss, MPI #108.
1) Benjamin Moore Corotech Polyamide Epoxy, Semi-Gloss, V400.
2) PPG Amercoat Amerlok, AK-400.
3) Sherwin-Williams Protective & Marine Macropoxy 646 Fast Cure Epoxy, B58W00610
f. 2nd Finish Coat: match Top Coat.
g. Top Coat: Polyurethane, Two-Component, Pigmented (Gloss Level 6-7), MPI #72.
1) Benjamin Moore Corotech Aliphatic Acrylic Urethane Gloss, V500.
2) PPG Pitthane Ultra Gloss Urethane Enamel 95-8xx Series.

3) Sherwin-Williams Protective & Marine Acrolon 218 HS, B65x600 Series.

3.07 SCHEDULE - WOOD STAINS AND TRANSPARENT FINISHES

A. Substrate: Wood: Dimensional Lumber, Dressed Lumber, Wood Paneling and Casework, interior. (Includes columns, beams, joists, exposed decking, wood trim, architectural woodwork, doors, windows, wood-based panel products, plywood, veneer panels, and casework.)

1. For painted wood finishes see Schedule above.
2. Standard Duty: Water-Based Varnish over Stain, MPI Systems EXT 6.2E / EXT 6.3E / .
   a. Stain: Semi-Transparent, Solvent-Based, MPI #13.
   b. 1st Finish Coat: match Top Coat.
   c. 2nd Finish Coat: match Top Coat.
   d. Top Coat: Water-Based Varnish, (Gloss Level 5), MPI #30.

END OF SECTION

SECTION 09 9123 - INTERIOR PAINTING & TRANSPARENT FINISHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface evaluation and preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
2. Prime surfaces to receive wall coverings.
3. Mechanical and Electrical:
   a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, electrical equipment, and cable protection sleeves, unless otherwise indicated.
   b. In finished areas, paint shop-primed items.
   c. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
   d. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

D. Do not paint or finish the following items, and protect existing items from painting operations.):

1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
2. Items indicated to receive other finishes.
3. Items indicated to remain unfinished.
4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
5. Fire alarm and data cabling, including fiber optic cables.
6. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
7. Marble, granite, slate, and other natural stones.
8. Floors, unless specifically indicated.
9. Ceramic and other tiles.
10. Brick, architectural concrete, cast stone, integrally colored plaster, and stucco.
11. Glass.
12. Concrete masonry units in utility, mechanical, and electrical spaces.
13. Acoustical materials, unless specifically indicated.
14. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 09 9113 - Exterior Painting.

1.03 DEFINITIONS

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

B. MPI Manual: the “Master Painters Institute Architectural Painting Specification Manual”, current edition.

C. MPI Repainting Manual: the “Master Painters Institute Maintenance and Repainting Manual”, current edition.

D. DSD: Degree of Surface Degradation, on a scale ranging from DSD-0 (Sound Surface) to DSD-4 (Substrate Damage), as defined by MPI. It shall be the basis of evaluating surfaces for required preparation.

E. RSP: Repaint Surface Preparation standards, as defined by MPI. The RSP is typically guided by the DSD level and type of defect or failure identified.

F. Gloss Levels indicated in this section follow the MPI Manual. Traditional gloss levels are included below for reference only.

MPI	Traditional	Gloss @ 60° (ASTM D523)	Sheen @ 85° (ASTM D523)
G1	Matte / Flat	5 maximum	10 maximum
G2	Velvet-like Flat, Eggshell	10 maximum	10-35
G3	Eggshell	10-25	10-35
G4	Satin	20-35	35+
G5	Semi-gloss	35-70	

G6	Gloss	70-85	
G7	High Gloss	85+	

1. Please note that some manufacturers' terms for traditional gloss levels may not coincide with the table above.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
B. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.
C. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2014.
D. ASTM D523 - Standard Test Method for Specular Gloss; 2014.
E. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.
F. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.
G. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; current edition, www.paintinfo.com.
H. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
I. SSPC V1 (PM1) - Good Painting Practice: Painting Manual, Volume 1; Fourth Edition.
J. SSPC V2 (PM2) - Systems and Specifications: Steel Structures Painting Manual, Volume 2; Fourth Edition.
K. SSPC-SP 1 - Solvent Cleaning; 2015.
L. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).
M. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's published product data sheet for each product to be used, including:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "acrylic latex").
   2. Highlight MPI product number (e.g. MPI #47).
   3. Manufacturer's installation instructions.
   4. Highlight substrates or conditions requiring special preparation.
B. Painting Schedule: prepared by installer for each system proposed, for each substrate, as follows:
   1. Substrate(s).
   2. MPI System designation.
   3. Assessment of existing surface condition(s).
      a. Reference MPI Repainting manual DSD-x designations, noting conditions which fall outside of what would be reasonably expected, or are not as indicated in the documents.
         1) Note: Not all surfaces are visible prior to award. Qualified bidders are assumed to have adequate experience to reasonably infer conditions based on building age, substrate, space type/use, and other observable conditions.
   4. Proposed minimum preparation(s) for previously finished surfaces.
      a. Reference MPI Repainting Manual RSP-x designations.
         1) Reference SSPC-SPx designations where cited by MPI manual for steel prep.
      b. Note: Where multiple options are indicated Contractor may employ any acceptable method. Should proposed method fail to adequately prepare surface, Contractor shall apply more stringent preparation at no additional cost to the Owner.
   5. Proposed minimum preparation for new unfinished surfaces, per MPI Manual. Proposed preparation methods selected by contractor shall adequately prepare surfaces to receive finish indicated.
      a. Reference MPI Manual INT-x designations.
   6. List of products to be applied in order from substrate to final coat, including any steps required between coats.
C. Reference Materials: Provide proof of ownership or on-line access to MPI and SSPC Manuals listed in Definitions above.
D. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
   2. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, factory finished metals, and wood doors, have been approved.
E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

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

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years documented experience.

1.07 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.09 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface, but not less than 30 ft candles over surface to receive finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
   1. If a single manufacturer cannot provide specified products; minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
      a. Exception: Specified products noted as "(NOT listed by MPI)" do not require submission as substitutions.
   2. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.
   3. Substitution of a different paint system using MPI-approved products by the same manufacturer will not be considered.
   4. Alternative products listed by MPI in the same category as specified products does not constitute an "equal" under this specification. Provide products as scheduled.

B. Paints:
   1. Benjamin Moore: www.benjaminmoore.com
   2. Pittsburgh Paints: www.ppgpaints.com/#sle.
   3. Sherwin-Williams Company: www.sherwin-williams.com. (Basis-of-Design for Color Selections)

C. Primer Sealers: Same manufacturer as Topcoats.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
   1. Where MPI paint numbers are specified without specific product names, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
   2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.

3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
4. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
5. Supply each paint material in quantity required to complete entire project's work from a single production run.
6. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
1) Opaque, Flat: 50 g/L, maximum.
2) Opaque, Nonflat: 50 g/L, maximum.
3) Opaque, High Gloss: 50 g/L, maximum.
4) Primers, sealers, and undercoatings: 100 g/L, maximum.
5) Anticorrosive and Antirust Paints Applied to Ferrous Metals: 100 g/L, maximum.
6) Zinc-Rich Industrial Maintenance Primers: 100 g/L, maximum.
7) Pre-treatment Wash Primers: 420 g/L, maximum.
8) Floor Coatings: 50 g/L, maximum.
9) Shellacs: 730 g/L, maximum.
c. Architectural coatings VOC limits of NY State.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Colors: As indicated on drawings.
1. Extend colors to surface edges; colors may change at any edge as directed by Architect.
2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under unless otherwise indicated.

2.03 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been adequately prepared.

B. Evaluate condition of existing surfaces using MPI's DSD rating guidelines.

C. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

F. Test shop-applied primer for compatibility with subsequent cover materials.

G. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
1. Gypsum Wallboard: 12 percent.
2. Plaster and Stucco: 12 percent.
3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
5. Concrete Floors and Traffic Surfaces: 8 percent.
a. See also 09 0561 - Common Work Results for Flooring Preparation.

3.02 PREPARATION - GENERAL

A. Clean surfaces thoroughly and correct defects prior to application.

B. This specification outlines minimum preparation guidelines for various substrates, but it is the responsibility of the Contractor to evaluate and prepare surfaces using recommended methods and guidelines per reviewed submittals, industry standards, manufacturer's recommendations, and MPI publications for achieving the best result for each substrate under the project conditions.
   1. Notify Prime Contractors responsible for newly installed surfaces which are not ready to receive specified finishes.
   2. Prepare new surfaces according to MPI INT 1.0, INT 1.1, and substrate specific recommendations.
   3. Prepare existing surfaces according to MPI RIN 1.0, RIN 1.1, substrate specific recommendations, and DSD.
   4. Prepare existing surfaces to meet manufacturer's published recommendations prior to application of primer.
   5. Where multiple methods are listed by MPI and Contractor's chosen method fails to adequately prepare surface, additional preparation using alternative methods listed shall be required, at no additional cost to the Owner.

C. Remove or repair existing paints or finishes that exhibit surface defects.

D. Remove surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew and algae from impervious surfaces by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry. See MPI RSP-9 (Mildew Treatment).

G. On existing surfaces remove abandoned, non-functioning items, such as surface mounted conduit, raceways, junction boxes, clips, brackets, fasteners, etc. Mechanical, electrical, and plumbing elements shall be removed by the appropriate trade contractors, unless otherwise indicated or directed

3.03 PREPARATION - SUBSTRATES

A. Concrete, Interior. (Non-Walking Surfaces):
   1. Prepare new surfaces per MPI INT 1.1 (Environmental) and INT 3.1 (Concrete Vertical Surfaces).
   2. Prepare existing previously finished surfaces per RIN 1.2 (PH Testing) and RIN 3.1 (Concrete Vertical Surfaces).
      a. Existing Surface/Finish Condition: Assume for Bidding at least DSD-2 (Moderately Deteriorated).
   3. Remove release agents, curing compounds, and simialar contaminates per MPI RSP-13 (Detergent Cleaning).
   4. Remove oils, grease, asphalt, waxes, and similar contaminates per MPI RSP-2 (Solvent Cleaning).
   5. Remove efflorescence and chalk per MPI RSP-8 (Efflorescence Removal).

B. Concrete Masonry Units:
   1. Prepare new surfaces per MPI INT 1.1 (Environmental) and INT 4.2 (Concrete Masonry Units).
   2. Prepare existing previously finished surfaces per RIN 1.2 (PH Testing) and RIN 4.2 (Concrete Masonry Units).
      a. Existing Surface/Finish Condition: Assume for Bidding at least DSD-2 (Moderately Deteriorated).
   3. Remove efflorescence and chalk per MPI RSP-8 (Efflorescence Removal).

C. Gypsum Board:
   1. Gypsum board shall be finished in accordance with levels defined in ASTM C840, as follows:
      a. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish (MPI G5 or greater) and as indiicated.
      b. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. All pinholes from pictures, posters, etc. and small holes, cracks, etc. must be filled sanded smooth. All tape and residual adhesive must be removed. Fill cracks, holes and imperfections with patching compound and sand smooth to match adjoining surfaces. Spot prime defects after repair.
      a. Final finish on patched surfaces shall match existing texture.

D. Plaster:
   1. Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
      a. Final finish on patched surfaces shall match existing texture.

E. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

F. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

G. Copper: Remove contamination by steam, high-pressure water, or solvent washing.

H. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
   2. Prepare surface according to SSPC-SP 2.

I. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.
2. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

J. Wood Surfaces: For field finishing of wood millwork, casework, trim, etc., refer to AWMAC/WI (NAAWS).

K. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

L. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

M. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

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

3.04 APPLICATION

A. Remove louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately, including backs and sides.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. 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.

D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied and fully cured.

E. 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.

F. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

G. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

H. 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.

I. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

J. Sand wood and metal surfaces lightly between coats to achieve required finish.

K. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

L. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

M. After paint is sufficiently dry, reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

B. Owner may provide field testing.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.06 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from 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. Remove tape, masking, and protective materials including residues.

D. 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.

3.07 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged substrates and finishes after Substantial Completion.

3.08 SCHEDULE - MPI PAINT SYSTEMS

A. Substrate: Concrete, Interior. (Non-Walking Surfaces)

1. Standard Duty: Institutional Low-Odor/VOC Latex, MPI System INT 3.1M / RIN 3.1L.
   a. Prep (new surfaces): as recommended by MPI INT 3.1.

b. Existing Surface/Finish Condition: Assume for Bidding at least DSD-2 (Moderately Deteriorated).
c. Prep (existing previously finished surfaces): as recommended by MPI for surface condition .
d. Primer: Latex, interior, institutional low odor/VOC, MPI #149. Use on new/unpainted surfaces.
1) Benjamin Moore Ultra Spec 500 WB Interior Primer, 534.
2) PPG Paints Pure Performance Interior Latex Primer, 9-9xx.
3) Sherwin-Williams Harmony Interior Latex Primer, B11W01500.
e. Primer: Alkali Resistant, Water Based, MPI #3. For use at unfinished surfaces with a pH above 10 and less than 13.
1) Benjamin Moore Ultra Spec Interior/Exterior 100% Acrylic Masonry Sealer, 608.
2) PPG Paints Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer, 17-921XI Series.
3) Sherwin-Williams Loxon Concrete & Masonry Primer, A24W8300 Series.
f. Primer / Touch Up: match Topcoat. Use on previously painted surfaces.
g. Intermediate Coat: match Topcoat.
h. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 1), MPI #143. For use at ceiling plane.
1) Benjamin Moore Regal Select Interior Latex, 547, Flat.
2) PPG Paints Pure Performance Interior Latex, 9-1xx Series, Flat.
3) Sherwin-Williams Harmony Interior Acrylic Latex, B05W0105x, Flat.
i. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 2), MPI #144. For use at wall plane.
1) Benjamin Moore Regal Select Interior Latex, 549, Eggshell.
2) PPG Paints Pure Performance Interior Latex, 9-3xx Series, Eggshell.
3) Sherwin-Williams Harmony Interior Acrylic Latex, B09W0105x, Eg-Shel.

B. Substrate: CMU, Interior.
1. Standard Duty: Institutional Low-Odor/VOC Latex, MPI System INT 4.2E / RIN 4.2L.
a. Prep (new surfaces): as recommended by MPI INT 4.2.
b. Existing Surface/Finish Condition: Assume for Bidding at least DSD-2 (Moderately Deteriorated).
c. Prep (existing previously finished surfaces): as recommended by MPI for surface condition, but not less than .
d. Primer: Block filler, Latex, Interior/Exterior, MPI #4. Use on new/unpainted surfaces.
1) Benjamin Moore Ultra Spec Interior/Exterior High-Build Masonry Block Filler, 571.
2) PPG Paints SpeedhideInterior/Exterior Masonry Hi Fill Latex Block Filler, 6-15XI.
3) Sherwin-Williams Pro Industrial Heavy Duty Block Filler, B42W00150.
e. Primer / Touch Up: match Topcoat. Use on previously painted surfaces.
f. Intermediate Coat: match Topcoat.
g. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 2), MPI #144. For use at wall plane.
1) Benjamin Moore Regal Select Interior Latex, 549, Eggshell.
2) PPG Paints Pure Performance Interior Latex, 9-3xx Series, Eggshell.
3) Sherwin-Williams Harmony Interior Acrylic Latex, B09W0105x, Eg-Shel.
2. Heavy Duty: Water Borne Light Industrial Coating, MPI System INT 4.2K / RIN 4.2G.
a. Prep (new surfaces): as recommended by MPI INT 4.2.
b. Existing Surface/Finish Condition: Assume for Bidding at least DSD-2 (Moderately Deteriorated).
c. Prep (existing previously finished surfaces): as recommended by MPI for surface condition .
d. Primer: Block filler, Latex, Interior/Exterior, MPI #4. Use on new/unpainted surfaces.
1) Benjamin Moore Ultra Spec Interior/Exterior High-Build Masonry Block Filler, 571.
2) PPG Paints SpeedhideInterior/Exterior Masonry Hi Fill Latex Block Filler, 6-15XI.
3) Sherwin-Williams Pro Industrial Heavy Duty Block Filler, B42W00150.
e. Primer / Touch Up: match Topcoat. Use on previously painted surfaces.
f. Intermediate Coat: match Topcoat.
g. Topcoat: Light Industrial Coating, Interior, Water Based, (Gloss Level 3), MPI #151. For use at wall plane.
1) Benjamin Moore Corotech Pre-Catalyzed Waterborne Epoxy, Eggshell, V342.
2) PPG Pitt-Glaze Interior Pre-Catalyzed Water-Borne Acrylic Epoxy, Eggshell, 16-310 Series.
3) Sherwin-Williams Pre-Catalyzed Waterbased Epoxy, Eg-Shel, K45-15x Series.

C. Substrate: GWB and Plaster, Interior.
1. Standard Duty: Institutional Low-Odor/VOC Latex, MPI System INT 9.2M / RIN 9.2M.
a. Prep (new surfaces): as recommended by MPI INT 9.2.
b. Existing Surface/Finish Condition: Assume for Bidding at least DSD-2 (Moderately Deteriorated).
c. Prep (existing previously finished surfaces): as recommended by MPI for surface condition .
d. Primer: Latex, interior, institutional low odor/VOC, MPI #149. Use on new/unpainted surfaces.

1) Benjamin Moore Ultra Spec 500 WB Interior Primer, 534.
2) PPG Paints Pure Performance Interior Latex Primer, 9-900.
3) Sherwin-Williams Harmony Interior Latex Primer, B11W01500.

e. Primer: Latex, interior, stain-blocking, MPI #137. Use on previously painted surfaces.
1) Benjamin Moore Fresh Start High-Hiding All Purpose Primer, 046.
2) PPG Paints Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer, 17-921XI Series.
3) Sherwin-Williams Multi-Purpose Interior/Exterior Latex Primer/Sealer, B51-450 Series.

f. Intermediate Coat: match Topcoat.

g. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 1), MPI #143. For use at ceiling plane.
1) Benjamin Moore Regal Select Interior Latex, 547, Flat.
2) PPG Paints Pure Performance Interior Latex, 9-1xx Series, Flat.
3) Sherwin-Williams Harmony Interior Acrylic Latex, B05W0105x, Flat.

h. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 2), MPI #144. For use at wall plane.
1) Benjamin Moore Regal Select Interior Latex, 549, Eggshell.
2) PPG Paints Pure Performance Interior Latex, 9-3xx Series, Eggshell.
3) Sherwin-Williams Harmony Interior Acrylic Latex, B09W0105x, Eg-Shel.

2. Heavy Duty: Water Borne Light Industrial Coating, MPI System INT 9.2L / RIN 9.2LL.

a. Prep (new surfaces): as recommended by MPI INT 9.2.

b. Existing Surface/Finish Condition: Assume for Bidding at least DSD-2 (Moderately Deteriorated).

c. Prep (existing previously finished surfaces): as recommended by MPI for surface condition .

d. Primer: Latex, interior, MPI #50. Use on new/unpainted surfaces.
1) Benjamin Moore Ultra Spec 500 WB Interior Primer, 534.
2) PPG Paints Pure Performance Interior Latex Primer, 9-900.
3) Sherwin-Williams Harmony Interior Latex Primer, B11W01500.

e. Primer: Latex, interior, stain-blocking, MPI #137. Use on previously painted surfaces.
1) Benjamin Moore Fresh Start High-Hiding All Purpose Primer, 046.
2) PPG Paints Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer, 17-921XI Series.
3) Sherwin-Williams Multi-Purpose Interior/Exterior Latex Primer/Sealer, B51-450 Series.

f. Intermediate Coat: match Topcoat.

g. Topcoat: Light Industrial Coating, Interior, Water Based, (Gloss Level 3), MPI #151. For use at wall plane.
1) Benjamin Moore Corotech Pre-Catalyzed Waterborne Epoxy, Eggshell, V342.
2) PPG Pitt-Glaze Interior Pre-Catalyzed Water-Borne Acrylic Epoxy, Eggshell, 16-310 Series.
3) Sherwin-Williams Pre-Catalyzed Waterbased Epoxy, Eg-Shel, K45-15x Series.

D. Substrate: Steel and Other Ferrous Metals, Interior.

1. Standard Duty: Institutional Low-Odor/VOC Latex, MPI System INT 5.1S / RIN 5.1S

a. Prep (new surfaces): as recommended by MPI INT 5.1.

b. Existing Surface/Finish Condition: Assume for Bidding at least DSD-2 (Moderately Deteriorated).

c. Prep (existing previously finished surfaces): as recommended by MPI for surface condition, but not less than MPI RSP-4 (Power Tool Cleaning) .
1) Reference: SSPC-SP 3 (Power Tool Cleaning),

d. Primer: Rust-inhibitive, water based MPI #107.
1) Benjamin Moore Ultra Spec HP Acrylic Metal primer, 04 Series.
2) PPG Paints Pitt-Tech Plus DTM Industrial Primer, 90-7xx Series. (High VOC's)
3) Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66x003x0 Series.

e. Intermediate Coat: match Topcoat.

f. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 1), MPI #143. For use at ceiling plane.
1) Benjamin Moore Regal Select Interior Latex, Flat, 547.
2) PPG Paints Pure Performance Interior Latex, Flat, 9-1xx Series.
3) Sherwin-Williams Harmony Interior Acrylic Latex, Flat, B05W0105x Series.

g. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 2), MPI #144. For use at wall plane.
1) Benjamin Moore Regal Select Interior Latex, 549, Eggshell.
2) PPG Paints Pure Performance Interior Latex, 9-3xx Series, Eggshell.
3) Sherwin-Williams Harmony Interior Acrylic Latex, B09W0105x, Eg-Shel.

h. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 5), MPI #147. For use at HM Doors and Frames.
1) Benjamin Moore Regal Select Interior Latex, Semi-Gloss, 551.

2) PPG Paints Pure Performance Interior Latex, Semi-Gloss, 9-5xx Series.
3) Sherwin-Williams Pro Industrial Interior Acrylic Latex, Semi-Gloss, K38W00351.

E. Substrate: Galvanized Metals, Interior.
1. Standard Duty: Institutional Low-Odor/VOC Latex, MPI System INT 5.3N / RIN 5.3K.
a. Prep (new surfaces): as recommended by MPI INT 5.3.
b. Existing Surface/Finish Condition: Assume for Bidding at least DSD-2 (Moderately Deteriorated).
c. Prep (existing previously finished surfaces): as recommended by MPI for surface condition, but not less than MPI RSP-4 (Power Tool Cleaning) .
1) Reference: SSPC-SP 3 (Power Tool Cleaning),
d. Primer: Galvanized, water based, MPI #134.
1) Benjamin Moore Ultra Spec HP Acrylic Metal primer, 04 Series.
2) PPG Paints Pitt-Tech Plus DTM Industrial Primer, 90-900 Series.
3) Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66x003x0 Series.
e. Intermediate Coat: match Topcoat.
f. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 1), MPI #143. For use at ceiling plane.
1) Benjamin Moore Regal Select Interior Latex, Flat, 547.
2) PPG Paints Pure Performance Interior Latex, Flat, 9-100 Series.
3) Sherwin-Williams Harmony Interior Acrylic Latex, Flat, B05W0105x Series.
g. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 2), MPI #144. For use at wall plane.
1) Benjamin Moore Regal Select Interior Latex, Eggshell, 549.
2) PPG Paints Pure Performance Interior Latex, Eggshell, 9-300 Series.
3) Sherwin-Williams Harmony Interior Acrylic Latex, Eg-Shel, B09W0105x Series.
h. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 5), MPI #147. For use at _____ .
1) Benjamin Moore Regal Select Interior Latex, Semi-Gloss, 551.
2) PPG Paints Pure Performance Interior Latex, Semi-Gloss, 9-500 Series.
3) Sherwin-Williams Pro Industrial Interior Acrylic Latex, Semi-Gloss, K38W00351.

F. Substrate: Aluminum (Not Anodized or Otherwise Coated), Interior.
1. Heavy Duty: Water Borne Light Industrial Coating, MPI System INT 5.4E / RIN 5.4E.
a. Prep (new surfaces): as recommended by MPI INT 1.4.
b. Existing Surface/Finish Condition: Assume for Bidding at least DSD-2 (Moderately Deteriorated).
c. Prep (existing previously finished surfaces): as recommended by MPI for surface condition, but not less than MPI RSP-2 (Solvent Cleaning) .
1) Reference: SSPC-SP 1 (Solvent Cleaning),
d. Primer: Quick dry, for aluminum, MPI #95. Use on new/unpainted surfaces.
1) Masterchem Industries; Kilz Complete Interior/Exterior Oil Based Primer, L1012.
2) PPG Paints Multiprime 4160.
3) Rust-Oleum XIM X Seal, 11301.
e. Primer: Galvanized, water based MPI #134. Use on previously painted surfaces.
1) Benjamin Moore Ultra Spec HP Acrylic Metal primer, 04 Series.
2) PPG Paints Pitt-Tech Plus DTM Industrial Primer, 90-900 Series.
3) Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66x003x0 Series.
f. Intermediate Coat: match Topcoat.
g. Topcoat: Light Industrial Coating, Interior, Water Based, (Gloss Level 3), MPI #151. For use at wall plane.
1) Benjamin Moore Corotech Pre-Catalyzed Waterborne Epoxy, Eggshell, V342.
2) PPG Pitt-Glaze Interior Pre-Catalyzed Water-Borne Acrylic Epoxy, Eggshell, 16-310 Series.
3) Sherwin-Williams Pre-Catalyzed Waterbased Epoxy, Eg-Shel, K45-15x Series.
h. Topcoat: Light Industrial Coating, Interior, Water Based, (Gloss Level 5), MPI #153. For use at _____ .
1) Benjamin Moore Corotech Pre-Catalyzed Waterborne Epoxy, Semi-Gloss, V341. (NOT listed by MPI.)
2) PPG Pitt-Glaze Interior Pre-Catalyzed Water-Borne Acrylic Epoxy, Semi-Gloss, 16-510 Series.
3) Sherwin-Williams Pre-Catalyzed Waterbased Epoxy, Semi-Gloss, K46-15x Series.

END OF SECTION

SECTION 10 1100 - VISUAL DISPLAY UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Porcelain enamel steel markerboards.
B. Tackboards.
C. Horizontal sliding visual display units.
D. Tackable wall panels.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking and supports.
B. Section 09 2116 - Gypsum Board Assemblies: Concealed supports in metal stud walls.
C. Section 09 9123 - Interior Painting & Transparent Finishing: Finishing of wood frame and marker rail.

1.03 REFERENCE STANDARDS

A. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.
B. ANSI A208.1 - American National Standard for Particleboard; 2009.
C. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2009a (Reapproved 2016).
D. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board; 2012.
E. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2024.
F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's data on porcelain enamel steel markerboard, tackboard surface covering, trim, and accessories.
B. Shop Drawings: Indicate wall elevations, dimensions, joint locations , special anchor details.
    1. Include Product Schedule: Use same dsignations indicated on Drawings.
C. Test Reports: Show compliance to specified surface burning characteristics requirements.
D. Manufacturer's Qualification Statement.
E. Warranties: Sample of special warranties.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of motor-operated, sliding visual display units required for this Project.
C. Source Limitations: Obtain visual display surfaces from single source from single manufacturer.
D. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 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.
E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate appearance and aesthetic effects and set quality standards for installation.
    1. Build mockup of typical wall area as shown on Drawings. Include accessories.
    2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
F. Pre-installation Conference: Attend conference at Project site.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display surfaces until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
B. Retain paragraph below if natural-slate chalkboards are included or if close tolerances are anticipated.

C. Field Measurements: Verify actual dimensions of construction contiguous with visual display surfaces by field measurements before fabrication.
   1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.07 WARRANTY

A. Provide 50 year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.
B. Glass Markerboards: 10 Year Limited Warranty

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Claridge Products and Equipment, Inc: www.claridgeproducts.com/#sle.
B. MooreCo, Inc: www.moorecoinc.com/#sle.
C. Polyvision Corporation: www.polyvision.com/#sle.
D. AARCO Products, Inc.
E. Egan Visual, Inc.

2.02 VISUAL DISPLAY UNITS

A. Markerboards: ASTM A 424; Porcelain enamel on steel, laminated to core.
   1. Color: White.
   2. Steel Face Sheet Thickness: 24 gauge, 0.0239 inch .
   3. Core: Particleboard, 1/2 inch thick, laminated to face sheet.
   4. Backing: Aluminum foil, laminated to core.
   5. Size: As indicated on drawings.
   6. Frame: Extruded aluminum , with concealed fasteners.
   7. Frame Finish: Anodized, natural.
   8. Accessories:
      a. Accessories: Provide marker tray, continuous, with end caps.
      b. Mechanical Fasteners: Concealed Z-clip attachment
      c. Joinery at Seams: Where one continuous surface is not possible due to size, provide Concealed Aluminum spline bar (visible H spline not acceptable).
B. Tackboards: Composition cork.
   1. Cork Thickness: 1/4 inch.
   2. Color: As selected from manufacturer's full range.
   3. Backing: Hardboard, 1/4 inch thick, laminated to tack surface.
   4. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.
   5. Size: As indicated on drawings.
   6. Frame: Extruded aluminum , with concealed fasteners.
   7. Frame Finish: Anodized, natural.
   8. Accessories: Provide Mechanical Fasteners: Concealed Z-Clip Attachment.
C. Horizontal Sliding Visual Display Unit: Cabinet with sliding panels and fixed rear panel.
   1. Cabinet:
      a. Tracks: Two.
      b. Size: As indicated on drawings.
      c. Frame: Extruded aluminum, with concealed fasteners.
      d. Frame Finish: Anodized, natural.
   2. Configuration:
      a. Two-Track:
         1) 2 Sliding Panels: Each panel not less than one-half of unit length.
   3. Sliding Panels: Markerboard.
   4. Fixed Rear Panel: Markerboard.
   5. Sliding Panels - General:
      a. Size: As indicated on drawings.
      b. Nylon Rollers: Two per panel up to 4 feet wide and three per panel up to 8 feet wide.

c. Finger Pulls: One pair per sliding panel.

6. Sliding Markerboard Panels: Porcelain enamel on steel, laminated to core.
   a. Color: White.
   b. Steel Face Sheet Thickness: 24 gauge, 0.0239 inch.
   c. Core: Particleboard, manufacturer's standard thickness, laminated to face sheet.
   d. Backing: Aluminum foil, laminated to core.
7. Accessories: Provide marker tray.

D. Tackable Wall Panels: Composition cork; Factory-fabricated.
1. Size: As indicated on drawings.
2. Edge Molding: Provide metal "J-mold" type edge trim for exposed edges/
3. Adhesives: Provide manufacturer's recommended adhesive, primer, and sealer, produced for use on substrate shown on drawings. Provide materials which are mildew-resistant and non staining to wallcovering.

2.03 RAIL SUPPORT SYSTEM FOR VISUAL DISPLAY BOARDS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Claridge Products and Equipment, Inc
2. Egan Visual Inc
3. AARCO Products, Inc
4. PolyVision Corporation; a Steelcase company

B. Support Rails: Horizontal, wall-mounted, extruded-aluminum rails designed to receive hanger clip and to support visual display boards; capable of gripping and suspending paper directly from rail.
1. Finish: Clear anodic.

C. Hanger Clips: Extruded aluminum with finish to match rails; designed to support independent visual display boards by engaging support rail and top trim of board.

D. Honeycomb core in paragraph below is preferred for rail-supported visual display units because of its light weight. Thickness varies among manufacturers.

E. Visual Display Panels: Fabricated from not less than 3/8-inch- thick, kraft-paper honeycomb core; designed to be rigid and to resist warpage, and with aluminum trim designed to engage hanger clips.

2.04 MATERIALS

A. Porcelain Enameled Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel, with fired-on vitreous finish.
1. Shall be enameling grade cold rolled steel manufactured from a minimum of 30 percept post-consumer and post-industrial waste.
2. Enameling grade steel shall be coated with Porcelain Enamel.
3. 3-Coat process shall include:
   a. Bottom Ground Coat - 1.5 to 2.2 mils.
   b. Top Ground Coat - 2.0 to 2.8 mils.
   c. Top Cover Coat - 3.0 to 4.0 mils.
4. Gloss-Finish Cover Coat: Gloss as indicated; dry-erase markers wipe clean with dry cloth or standard eraser. Minimum 3.0-to-4.0-mil- thick cover coat. Cover and ground coats shall be fused to steel at manufacturer's standard firing temperatures but not less than 1475 deg F.

B. Resilient cork/linoleum Sheet: Seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed and calendared onto fabric backing; with washable vinyl finish and integral color throughout.
1. Products:
   a. Forbo, “Bulletin Board”.
   b. Claridge, “Bulletin Board”.
   c. Koroseal Interior Products, “Tac Wall”.

C. Hardboard for Cores: ANSI A135.4, Class 1 - Tempered, S2S (smooth two sides).

D. Particleboard: ANSI A208.1; wood chips, set with waterproof resin binder, sanded faces.

E. Class A Fiberboard (tackable): ASTM E84 Class A
1. Products:
   a. Homosote, N.C.F.R Homasote.
   b. USG, Micore Mineral Fiber Board
   c. Architect Approved Equal.

F. Fiber Board: ASTM C208, cellulosic fiber board.
G. Foil Backing: Aluminum foil sheet, 0.005 inch thick.
H. Extruded Aluminum: ASTM B 221, Alloy 6063.
I. Adhesives: Type used by manufacturer.

2.05 ACCESSORIES

A. Temporary Protective Cover: Sheet polyethylene, 8 mil thick.
B. Cleaning Instruction Plate: Provide instructions for chalkboard cleaning on a metal plate fastened to perimeter frame near marker rail.
C. Marker Tray: Aluminum, manufacturer's standard profile, one piece full length of markerboard, molded ends, concealed fasteners, same finish as frame.
D. Mounting Brackets: Concealed.

2.06 FABRICATION

A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.
B. Visual Display Boards: Factory assemble visual display boards unless otherwise indicated.
    1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.
C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
    1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
    2. Provide manufacturer's standard vertical-joint spline system between abutting sections of markerboards.
    3. Provide manufacturer's standard mullion trim at joints between markerboards and tackboards of combination units.
    4. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.
D. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.
    1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

2.07 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
C. 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.

2.08 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
B. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.
C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.
C. Verify flat wall surface for frameless adhesive-applied boards.
D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair the performance of and affect the smooth, finished surfaces of visual display boards, including dirt, mold, and mildew.
C. Acclimatize tackable wall panels by removing from packaging in installation area not less than 24 hours before application.
D. Remove switchplates, wall plates, and surface-mounted fixtures where tackable wall paneling is applied. Reinstall items on completion of installation.
E. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install boards in accordance with manufacturer's instructions.
B. Install at heights inidicated in drawings.
C. Secure units level and plumb.
D. Butt Joints: Install with tight hairline joints.
E. Carefully cut holes in boards for thermostats.
F. Install tackable wall panels in accordance with manufacturer's recommendations on specified substrates with concealed attachments.

3.04 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.
B. Cover with protective cover, taped to frame.
C. Remove temporary protective cover at Date of Substantial Completion.

END OF SECTION

SECTION 10 1200 - DISPLAY CASES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Recessed display cases.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking and supports.
B. Section 09 2116 - Gypsum Board Assemblies: Concealed supports in metal stud walls.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.
B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.
D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

1.04 SUBMITTALS

A. Product Data: Submit complete printed data and installation details indicating products to be provided as specified.
    1. Submit color charts for selection by the Architect.
B. Shop Drawings: Submit complete installation details. Include dimensioned elevations.
C. Samples: Submit samples of material and trim to illustrate finish, color, and texture.
D. Manufacturer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver display cases and materials to the Project site with manufacturer’s protective crate covering and do not open until ready for use.
B. Protect display cases before, during, and after installation. In case of damage, immediately provide necessary repairs and replacements.

1.07 FIELD CONDITIONS

A. Field Measurements: Verify field measurements for recessed application for display cases before preparation of shop drawings and before fabrication to ensure proper installation.

1.08 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion.
B. Provide five year manufacturer warranty against defects and in materials, finish product and workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Claridge Products and Equipment, Inc: www.claridgeproducts.com/#sle.
B. MooreCo, Inc: www.moorecoinc.com/#sle.
C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DISPLAY CASES

A. Recessed Bulletin Board Display Case: Factory-fabricated wood-framed display case with adjustable glass shelves, finished interior, and aluminum trim on face to cover edge of recessed opening.
    1. Basis of Design: Claridge Revere Bulletin Board Cabinet
    2. Width: As indicated on drawings.
    3. Height: As indicated on drawings.
    4. Depth: As indicated on drawings.

5. Components:
    a. Glazed Doors: Hinged.
    b. Back Panel: Tackable.
    c. Frame Construction: 1" x 3" Hollow tube perimeter.

2.03 COMPONENTS

A. Frame Construction: 1 inch by 3 inchextruded aluminum tube frame.
B. Glazed Hinged Doors:
    1. 1/4 inch clear tempered glass framed with 1/2 inch by 1 inch extruded aluminum trim.
    2. Hinges: 1 inch by .040 inch nickel-plated steel-continuous piano hinges.
    3. Lock: Glass door cylinder lock.
C. Tackable Back Panel: Composition cork on hardboard.
    1. Cork Thickness: 1/8 inch.

2.04 MATERIALS

A. Aluminum Extrusions for Framing and Trim: Alloy as recommended by manufacturer for construction and specified finish; nominal 1/8 inch wall thickness.
B. Aluminum Extrusions: ASTM B221 (ASTM B221M), 6063 alloy, T5 temper.
    1. Finish: Factory anodized; AAMA 611: Clear anodized.
C. Heat-Strengthened and Fully Tempered Glass: ASTM C1048, Kind FT.

PART 3 EXECUTION

3.01 PREPARATION

A. Rough openings, electrical pre-wiring, and final finishing are by other trades.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Provide factory trained installers.
C. Locate fastening devices to secure cases securely to back and sides of rough opening.
D. Refer to drawings for display case mounting heights.
E. Clean case and glass using manufacturers recommended procedures.
F. Provide mitered and wrapped hairline joints for all trims.

3.03 ADJUSTING AND CLEANING

A. Verify that all accessories are installed as detailed for each unit.
B. At completion of work, clean glass surfaces, back panels and trim in accordance with manufacturer’s recommendations leaving units ready for use.

END OF SECTION

SECTION 10 1400 - SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Panel Signs: Room and door signs.

1.02 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Reapproved 2011).

D. ASTM D4802 - Standard Specification for Poly(Methyl Methacrylate) Acrylic Plastic Sheet; 2016.

E. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

1.03 SUBMITTALS

A. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

B. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.

1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
3. Submit for approval by Owner through Architect prior to fabrication.

C. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

D. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

E. Manufacturer's Qualification Statement.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.04 QUALITY ASSURANCE

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

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

1.07 WARRANTY

A. Specialty Warranty: Manufacturer agrees to repair or replace components of signs that fall in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to the following:
   a. Deterioriation of finishes beyond normal weathering.
   b. Deterioriation of embedded graphic image.
   c. Separation or delamination of sheet materials and components.
2. Warranty Period: 5 Years from Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Panel Signs:
   1. Takeform
   2. Inpro: www.inprocorp.com/#sle.
   3. ASI Sign Systems, Inc.
   4. 2/90 Signs.

2.02 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Egress Map Holders:
   1. Sign Type: Flat signs with engraved panel media as specified.
   2. Character Height: 1 inch.
   3. Sign Type 2: Room Identification Sign with Two Lines of Copy
      a. Basis of Design: Takeform - Vivid Collection
      b. Size: 6" Wide x 6" High
      c. Locations: As indicated in Drawings.
   4. Sign Type 3B: Identify with two lines of copy including room names and numbers to be determined later, not those indicated on drawings; in addition, provide "window" section for replaceable insert.
      a. Basis of Design: Takeform - Vivid Collection - Type J.6 - V1AJ06
      b. Size: 19.5" Wide x 9" High
      c. Locations: As indicated in Drawings.
   5. Sign Type 6: Emergency Exit Plan Sign
      a. Size: 13" Wide x 11" High
      b. Configuration: Double Layer sign with 8" high x 10-1/2"wide clear window for paper insert.
      c. Locations: (2) Required per Classroom Control Panels

2.03 PANEL SIGNS

A. Flat Panel Signs: Signage media without frame.
   1. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille; in adherence to ADA Specifications.
   2. Signage shall be capacble of accepting direct prints including colors, patterns, graphic images and photography. Prints shall be second surface to protect from scratches, fading or other damage.
   3. All Signage, including but not limited to room ID's, directionals, and directories, shall have matching appearance and constructed utilizing the same manufacturing process to ensure a consistent look throughout.
   4. The entire sign shall be 65% post industrial waste and 100% recyclable under Code 7.
   5. Thickness: Manufacturer's standard for size of sign.
   6. Edges: Square.
   7. Corners: Square.
   8. Wall Mounting of One-Sided Signs: Tape adhesive.
   9. Flatness Tolerance: Sign panel shall remain flat or uniformly curved under installed conditions as indicated and within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner.
   10. Flammability: Class "A" - Flame Spread 0-25, Smoke developed 250 or less.
   11. Quantity: New Signs for newly constructed or remodeled spaces only.

B. Color and Font: Unless otherwise indicated:
   1. Character Font: Helvetica, Arial, or other sans serif font.
   2. Character Case: Upper case only.
   3. Background Color: As scheduled.
   4. Character Color: Contrasting color.

C. Materials:
   1. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV Filtering).
      a. Signage shall be fabricated of acrylic,.375 inch thick, comprised of two layers. Edges shall be smooth without chips, burrs, sharp edges or marks. The direct print shall be second surface to prevent scratching, fading, or other damage.
      b. Acrylic shall be non-glare optically clear with a P99 finish assuring no loss of clarity or composition of the print.

c. Tactile lettering shall be precision machined, raised 1/32 inch, matte PETG and subsurface colored for scratch resistance.
d. The signage shall utilize a pressure activated adhesive. The adhesive shall be nonhazardous and shall allow for flexing and deflection of the adhered components due ot changes in temperature and humidity without bond failure.
e. Signage shall have an acrylic shim plate. The shim shall lift the sign off the wall to facilitate cleaning and painting without sign removal.
f. All signs shall be provided with appropriate mounting hardware. All hardware shall have a polished anondized finish, architectural in appearance and suitable for the mounting surface.

2. Printed Inserts
a. The signage shall be capable of accepting paper inserts to allow changing and updating as required. Insert components shall have a 0.040 inch thickness non-glare acrylic window and shall be flush to sign face for a smooth, seamless appearance.
b. Manufacturer shall provide a template containing layout, font, color, artwork, and trim lines, to all Owner to produce inserts on laser or ink jet printer. The template shall be in an Acrobat or Word Format (.pdf).

2.04 ACCESSORIES

A. Tape Adhesive: Double sided tape, permanent adhesive.
B. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, non-corrosive and compatible with each material joined, and complying with the following:
1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish non-ferrous-metal devices unless otherwise indicated.
3. Exposed Metal-Fastener Components, General:
a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
b. Fastener Heads: For non-structural connections, use flathead screws and bolts with tamper-resistant Allen-head or one-way-headslots unless otherwise indicated.
4. Sign Mounting Fasteners:
a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.
b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.
c. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in pre-drilled holes.
5. Inserts: Furnish inserts to be set by other trades into concrete or masonry work.
C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work; including verification that the sign surfaces are clean and free of materials or debris that would impair installation.
B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated
C. Verify that anchor inserts are correctly sized and located to accommodate signs.
D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install in accordance with manufacturer's instructions.
1. Install neatly, with horizontal edges level.
2. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
3. Protect from damage until Date of Substantial Completion; repair or replace damaged items.
B. Mounting Methods
1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.

b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.

3. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

C. Field-Applied, Vinyl Character Signs: Clean and dry substrate. Align sign characters in final position before removing release liner. Remove release liner in stages, and apply and firmly press characters into final position. Press from the middle outward to obtain good bond without blisters or fishmouths. Remove carrier film without disturbing applied vinyl film.

D. Signs Mounted on Glass: Provide obpaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

3.03 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs acording to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protection from damage until acceptance by Owner.

END OF SECTION

SECTION 10 4400 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.
B. Fire extinguisher cabinets.
C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.
B. Section 09 9123 - Interior Painting & Transparent Finishing: Field paint finish.

1.03 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a.
B. NFPA 10 - Standard for Portable Fire Extinguishers; 2013.

1.04 SUBMITTALS

A. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, and color and finish.
B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:
   1. Kidde, a unit of United Technologies Corp.,: www.kidde.com. (BASIS OF DESIGN)
   2. Larsen's Manufacturing Company: www.larsensmfg.com.
   3. Nystrom, Inc: www.nystrom.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.
B. Fire Extinguisher Cabinets and Accessories: Procure cabinets from same manufacturer as exstiguishers.
   1. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
   2. Larsen's Manufacturing Co: www.larsensmfg.com/#sle.
   3. Modern Metal Products, Division of Technico, Inc.; www.modern-metal.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. Cartridge Operated: Spun shell.
   2. Class: A:B:C type.
   3. Size: 10 pound.
   4. Finish: Baked polyester powder coat, color as selected.
   5. Temperature range: Minus 40 degrees F to 120 degrees F.

2.03 FIRE EXTINGUISHER CABINETS

A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.
B. Fire Rated Cabinet Construction: One-hour fire rated.
   1. Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick, fire-barrier material. Provide factory-drilled mounting holes.
C. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
   1. Trimless with Hidden Flange: Flange of same metal and finish as box overlaps surrounding wall finish and is concealed from view by an overlapping door.
D. Cabinet Fabrication: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
   1. Weld joints and grind smooth.
   2. Provide factory-drilled mounting holes.
E. Cabinet Trim Fabrication: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

F. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

G. Door Fabrication: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
2. Fabricate door frames of one-piece construction with edges flanged.
3. Miter and weld perimeter door frames.

2.04 ACCESSORIES

A. Lettering: FIRE EXTINGUISHER decal, or vinyl self-adhering, pre-spaced black lettering

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

B. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.

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

D. Verify existing conditions before starting work.

E. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 11 1319 - STATIONARY LOADING DOCK EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Edge of dock (EOD) levelers.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

B. Section 05 5213 - Pipe and Tube Railings: Safety railings and gates.

1.03 REFERENCE STANDARDS

A. ANSI MH30.1 - Performance and Testing Requirements for Dock Leveling Devices; 2015.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates; 2015.

D. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.

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

1.04 SUBMITTALS

A. Product Data: Provide materials and finish, installation details, roughing-in measurements, and operation of unit and safety lock device.

B. Manufacturer's Qualification Statement.

C. Installer's Qualification Statement.

D. Operation Data: Provide operating instructions, and identify unit limitations.

E. Maintenance Data: Provide unit maintenance information, lubrication cycles, and spare parts manual.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least five years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Edge of Dock (EOD) Levelers:

1. Rite-Hite Corp; RHE-300 : www.ritehite.com/#sle. (BASIS OF DESIGN)
2. Blue Giant Equipment Corporation: www.bluegiant.com/#sle.
3. Kelley, an Assa Abloy Group company: www.kelleydocksolutions.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 EDGE OF DOCKS (EOD) LEVELERS

A. Edge of Dock (EOD) Levelers: Hinged-edge type, in compliance with ANSI MH30.1, and located at exterior edge and securely mounted to face of loading dock.

1. Actuating Method:
   a. Hydraulic: Activated with electric control by operator depressing weatherproof control button to raise edge and deck into fully extended position, and lower edge onto trailer bed.
      1) Provide packaged unit with unitized, totally enclosed, non-ventilated electric motor, pump, manifold reservoir, and valve assembly of proper size, type, and operation for capacity indicated.
2. Rated Capacity: Capable of supporting 20,000 lbs without permanent deflection or distortion.
3. Width of Platform Ramp: 66 inch wide.
4. Hinged Edge Thickness: At least 3/8 inch thick, nonskid steel plate.
   a. Hinge: Provide full width, steel piano hinge with heavy-wall hinge tube and grease fittings with support gussets on edge and ramp.
5. Edge Extension Length: 15 inches long.
6. EOD leveler to compensate for differences in height between truck bed and loading dock platform, with operating range above platform level to enable edge to extend and clear truck bed prior to contact within following working range:
   a. Vertical Travel: Provide for not less than 3 inches above and 3 inches below adjoining platform.
7. Automatic Vertical Compensation: Floating travel of leveler ramp with edge extended to automatically compensate for upward and downward movement of truck bed during loading and unloading operations.

8. Edge Operation: Manufacturer's standard mechanism that automatically extends and supports hinged edge on ramp edge and rests on truck bed over leveler's working range, allows edge to yield under incoming truck impact and automatically retracts edge when truck departs.
9. Automatic Ramp Return: Automatic return of unloaded ramp as truck departs, from raised or lowered position to stored position, level with platform, and EOD leveler is also capable of retracting to stored position while truck is still at loading dock.

B. Construction: Fabricate EOD leveler frame, hinged edge and platform supports from structural and formed steel shapes, with platform and hinged edge welded to supports, chamfer edge to minimize obstructing material-handling vehicles, and ensure entire assembly is fabricated to withstand deformation during operation and storage phases of service.
1. Ramp Traffic Support: Provide support for EOD ramp at platform level in stored position with ramp edge retracted, and means to release supports allowing ramp to descend below platform level.
2. Ramp Maintenance Support: Provide mechanism in framework to support EOD ramp in up position during dock leveler maintenance.

C. EOD Leveler Finish: Manufacturer's standard finish.

2.03 MATERIALS

A. Checkered Steel Plate: ASTM A786/A786M, rolled steel floor plate; manufacturer's standard pattern.

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

C. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized in accordance with ASTM A153/A153M where connecting galvanized hardware components.

2.04 ACCESSORIES

A. EOD Leveller to be supplied with intergal bumpers on both sides of leveller, no less that 16" in length

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine loading dock equipment area for compliance with requirements for installation tolerances and other conditions related to this work.

B. Examine rough-in for electrical systems of loading dock equipment to verify openings and locations are acceptable prior to installation of equipment.

3.02 PREPARATION

A. Prepare loading dock equipment for size and locations as indicated, and provide anchoring devices with templates, diagrams, and installation instructions.

3.03 INSTALLATION

A. Install EOD levelers to ensure arrangement is adequate to accommodate lift in proper relation to loading platform.
1. Anchor edge-of-dock leveler securely in place, in accordance with manufacturer’s written instructions.
2. Install electrical connections as required for fully operational system.
3. Weld anchor holes in contact with continuously embedded loading dock edge channel.
4. Weld or bolt bumper blocks to face of loading dock.

3.04 ADJUSTING

A. Adjust installed loading dock equipment and safety devices for smooth and balanced operation, and lubricate as recommended by manufacturer.

B. Test dock levelers for vertical travel within operating range as indicated, and adjust as necessary for proper operation.

C. After installation, inspect exposed factory finished loading dock equipment, and repair damaged finishes.

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 RELATED WORK

A. Examine contract documents for requirements that affect work of this section. Other specification sections that directly relate to the work of this section include, but are not limited to:
   1. Division 26 Sections for electrical service for motor operators, controls, and other powered devices for motorized gymnasium equipment.

1.3 SUMMARY

A. Section Includes
   1. Basketball Equipment
   2. Control Systems

1.4 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
   1. FIBA: International Basketball Federation (Federation Internationale de Basketball Amateur).
   2. NAGWS: The National Association for Girls and Women in Sport.
   3. NCAA: The National Collegiate Athletic Association.
   4. NFHS: The National Federation of State High School Associations.

1.5 DEFINITIONS

A. BWF: Badminton World Federation.

B. FIBA: Federation Internationale de Basketball Amateur (The International Basketball Federation).

C. FIVB: Federation Internationale de Volleyball (The International Volleyball Federation).

D. NCAA: The National Collegiate Athletic Association.

E. NFHS: National Federation of State High School Associations.

F. USAV: USA Volleyball.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Include details of anchors, hardware, and fastenings.
   3. Include assembly, disassembly, and storage instructions, if applicable.
   4. Gymnasium Equipment Operators: Include operating instructions.
   5. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.

B. Shop Drawings:
   1. Show location and extent of fully assembled gymnasium equipment.
   2. Show location and extent of disassembled equipment and components and transport and storage accessories.
   3. Include elevations, sections, and details not shown in Product Data.

4. Show method of field assembly, connections, installation details, mountings, floor inserts, attachments to other Work, operational clearances, and relationship to adjoining work.
    a. Blocking and Reinforcement: Show locations of blocking and reinforcement required for support of gymnasium equipment.
    b. Setting Drawings: For cast in floor insert sleeves for post standards.
    c. Gymnasium Equipment Operators: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
    d. Wiring Diagrams: Power, signal, and control wiring.

C. Samples for Verification: For the following products:
1. Pad Fabric: Wall padding not less than 3 inches square, and corner and column samples not less than 3 inches long, with specified treatments applied. Mark face of material.

1.7 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Court layout plans, drawn to scale, and coordinated with floor inserts, game lines, and markers applied to finish flooring.

B. Qualification Data: For Installer.

C. Product Certificates: For each type of gymnasium equipment, signed by product manufacturer.

D. Warranty: For special warranties specified in this section.

1.8 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gymnasium equipment to include in emergency, operation, and maintenance manuals.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each type of gymnasium equipment through one source from single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Standards: Provide gymnasium equipment complying with or exceeding requirements of NFHS, National Federation of State High School Associations.

E. All composite wood products to be free of added urea formaldehyde.

F. Safety padding to be certified by Greenguard for Children and Schools.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install gymnasium equipment until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Verify position and elevation of floor inserts and layout for gymnasium equipment.

1.11 COORDINATION

A. Coordinate installation of floor inserts with structural floors and finish flooring installation and with court layout and game lines and markers on finish flooring.

B. Coordinate layout and installation of overhead-supported gymnasium equipment and suspension-system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

1.12 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions. Keep temporary protective coverings in place.

C. Handling: Protect materials and finish from damage during handling and installation.

1.13 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of gymnasium equipment that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Basketball backboard failures including glass breakage.
      b. Faulty operation of basketball backstops.
   2. Warranty Period: Ten (10) years from date of Substantial Completion.
      a. Lifetime warranty for basketball backstop, backboard and height adjustment system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Source Limitations: Obtain all gymnasium equipment, including but not limited to Basketball Backstop Systems, Volleyball Floor Plates and Sleeves and Wall Pads from single source and from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Basketball backstops and anchors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.3 BASKETBALL EQUIPMENT

A. Basis-of-Design Product: Products listed below by Porter Athletic Equipment Co.

B. Subject to compliance with requirements, products by one of the following may also be acceptable.
   1. Draper Inc.
   2. Jaypro Sports Construction Group.
   3. AALCO Manufacturing.
   4. Architect approved equal.

C. General: Provide equipment complying with requirements in NFHS's "NFHS Basketball Rules Book".

D. Protruding fasteners or exposed bolt heads on front face of backboards are not permitted.

E. Provide manufacturer's recommended connections complying with Division 05 Section METAL FABRICATIONS of size and type required to transfer loads to building structure.

A. Backstops - Provide complete assemblies including, but not limited to primary and secondary superstructure support framing to building structure, pipe and cable bracing, adjustable hangers, clamps, cables, chains, pulleys, fittings, hardware, and fasteners.

   1. Backstop Type A –
      a. Type: Center Strut, Ceiling Suspended, **Height Adjustable**, Forward Folding Backstops with Safety Devices
         1) Basis of Design: Porter No. 90949000
   2. Framing: Steel pipe, tubing and shapes. Design framing to minimize vibration during play.
   3. Single Mast Frame: Fully welded with diagonal side sway bracing.

4. Finish: Manufacturer's standard factory applied, baked powder coating finish complying with finish manufacturer's written instructions for surface preparation including pretreatment, application, baking and minimum dry film thickness.
5. Goal Height Adjuster: Integrated into Powr-Touch 2.5 system, adjustable from 8 to 10 feet, locking in 3-inch increments within adjustment range. Height adjuster to include visible height scale and finish matching backstop frame. Basis of Design: Porter No. 904-506
6. Operation: Integrated into digital master control system.

B. Backstop/Backboard Safety Device: Designed to limit free fall if support cable, support chain, pulleys, fittings, winch or related components fail; with mechanical automatic reset; 6000 lb. load capacity; one per folding backstop.
   1. Basis of Design: Porter No. 10797100 Saf-Strap

C. Retractor Device: Manufacturer's standard device designed to retract support and safety cables, chains, straps away from play of the basketball when backstop is in playing position; one per rear braced, forward folding backstop.
   1. Basis of Design: Porter No. 10799-200 Retractor Reel

D. Backstop Electric Operator: Factory assembled electric winch operator for backstop designed for lifting and lowering basketball equipment of type, size, weight, construction, use, and operation frequency indicated on drawings or as specified. Provide operation system, of size and capacity and with features, characteristics, and accessories suitable for Project conditions, recommended by gymnasium equipment manufacturer; complete with winch or hoist designed to move and hold backstop in any raised or lowered position, electric motor and factory prewired motor controls with limit controls, remote control stations, remote control devices, power disconnect switch, enclosures protecting controls and all operating parts, and accessories required for proper operation. Include wiring from motor controls to motor. Coordinate operator wiring requirements and electrical characteristics with the building electrical system. Entire Winch Assembly to be UL Approved.

   1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Operator Type: Cable drum with grooved drum and cable tension device to automatically take up cable slack and retain cable in grooves.
   3. Operator Mounting: Per manufacturer's standard mounting instructions.
   4. Motor Electrical Characteristics:
      a. Voltage:120 V
      b. Horsepower: As required by backstop configuration(s).
      c. Phase: Single.
   5. Remote-Control Station(s): See Section *2.6 Control Systems* for remote control integration of all backstop operations.
      a. Basis of Design: Porter No. 2550 Power Touch 2.5 Keypad Control System, with custom Equipment Legend. (1 Legend mounted to wall, 1 Legend turned over as laminated copy to OWNER)
   6. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop basketball equipment at fully retracted and fully lowered positions.

E. Basketball Backboards:
   1. Shape and Size:
      a. Rectangular, 72 by 42 inches width by height with rounded corners.

   2. Backboard Material: With manufacturers standard pre-drilled holes or preset inserts for mounting goals, and as follows:
      a. Glass: Not less than 1/2-inch- thick, transparent tempered plate glass complying with ASTM C 1048 Kind FT (fully tempered) and with impact testing requirements in 16 CFR 1201 Category II or ANSI Z97.1 Class A for safety glazing. Provide glass with impact-absorbing resilient rubber or PVC gasket around perimeter in a fully welded, painted steel tube frame, with steel sub-frame, reinforcement, bracing, and mounting slots for mounting backboard frame to backboard support framing.
         1) Standard Mount: Provide steel corner reinforcement with mounting slots for mounting backboard frame to backstop at standard mounting centers. Provide center-strut frame reinforcement.
         2) Direct Mount: Designed for mounting backboard frame to center mast of backstop to maximize relief of stresses on backboard frame and glass.
         3) Rim-Restraining Device: Complying with NCAA and NFHS rules and designed to ensure that basket remains attached if glass backboard breaks.
   3. Target Area and Border Markings: Permanently fired into glass in white color, marked in manufacturer's standard pattern and stripe width.
   4. Basis of Design: Porter No. 00208-000 Center Strut Rectangular Glass Backboard

F. Goal Mounting Assembly: Compatible with goal, backboard, and support framing; with manufacturers standard hole pattern for goal attachment.
   1. Glass Backboard Goal Mounting Assembly: Goal support framing and reinforcement designed to transmit load from goal to backboard frame and to minimize stresses on glass backboard.
   2. Direct Mount: Designed for mounting goal directly and independently to center mast of backboard support framing so no force, transmitted by ring, is directly applied to backboard, and rigidity and stability of goal are maximized.

G. Basketball Goals: Complete with flanges, braces, attachment plate, net and net locking system without wire hooks.
   1. Single Rim Basket Ring Competition Goal: Materials, dimensions, and fabrication complying with referenced rules.
   2. Steel Torsion-Rod Pivot/Tension Mechanism: Precision, case-hardened, high-tensile steel alloy torsion rod pivot design to allow tip of rim to flex approximately 2-1/2" with a 230 pound static load. Goal shall instantaneously return to the playing position when the load is released. Provide movable ring with rebound characteristics identical to those of fixed, non-movable ring.
   3. Mount: Independent, Front mount, with concealed hardware.
   4. Net: 12-loop-mesh net, between 15 and 18 inches long, sized to fit rim diameter, and as follows:
      a. Competition Cord: Anti-whip, made from white nylon cord not less than 120-gm thread and not more than 144-gm thread.
   5. Net Attachment: "tube-tie" system for attaching net to rim without tying.
   6. Finish: Manufacturer's standard official orange - factory applied, baked powder coating finish complying with finish manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.
   8. Basis of Design: Porter No. 252-500 TorqFlex.

H. Safety Pads: Provide safety pads for each rectangular glass backboard, complying with NCAA and NFHS, designed for backboard thickness indicated and extending continuously along bottom and up sides of backboard and over goal mounting and backboard supports as required by referenced rules.
   1. Safety Pad Attachment: Bolt on.
   2. Pads: 2-inch thick, molded from 9-lb density polyurethane foam with integral skin.
   3. Color: As selected by Architect from manufacturer's full range.
   4. Basis of Design: Porter No. 0326-000 ProPad.

2.4 CONTROL SYSTEMS

A. Master Control System
   1. Operation: Push-button control system capable of operating basketball backstops, height adjusters, divider curtains, mat hoists or other gymnasium equipment, and auxiliary gymnasium electrical equipment simultaneously.
   2. Operation Safety: For safety of operation, touch pad requires constant pressure on pad button to control gymnasium equipment.
   3. Control of Auxiliary Equipment: Single touch of appropriate button.
   4. Basketball backstops or height adjusters shall be operated individually or simultaneously by pressing single button.
   5. Desired Operation Mode: Selected at touch pad by entering assigned backstop or height adjuster number or combination backstops or height adjusters number.
   6. Security Code: Four-digit reprogrammable security code to prevent unauthorized use.
   7. Time Delay: Touch pad shall automatically revert back to secure mode if no button is used within 15 seconds.
   8. Mounting: Flush mounted in standard 2-gang electrical box, 4 inches by 4 inches by 2-1/2 inches, with 12-volt control circuit to relay panels located on walls or roof framing structure.
   9. Relay Panels: Provide one dual-powered relay panel, which shall individually or simultaneously control 2 backstops. Panel shall contain 2 banks of eight 30-amp relays for operating 10 momentary-controlled type (up and down), 115-volt or low-voltage pieces of equipment. Each bank of relays shall be independently powered by 115-volt line power, with 2 dedicated circuit breakers per relay panel. Relay panel shall include 2 maintained 30-amp relays.
   10. Relay Panel Enclosure: 4-3/8 inches by 14 inches by 17 inches.
   11. Touch Pad LEDs: Tri-color LED at touch pad for positive user feedback. Illuminates when proper security code is entered (green), when confirming touch pad button is fully depressed (amber), and while operating equipment up or down (red). Additional LEDs at touch pad and relay panel circuit boards to ensure system is receiving power, wired correctly, and relays are functioning properly.
   12. Touch Pad Wiring: Fuse protected for additional circuit protection.
   13. Basis of Design: Porter No. 2550 Power Touch 2.5, with custom Equipment Legend.

B. Electrical Contractor Shall Furnish and Install:
   1. All conduits complete with wire, from power source to control processor, from control processor to relay panels, from relay panels to devices and from control processor to touch pad.

2.5 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for use and finish type indicated.
   1. Extruded Bars, Profiles, and Tubes: ASTM B 221.
   2. Cast Aluminum: ASTM B 179.
   3. Flat Sheet: ASTM B 209.

B. Steel: Comply with the following:
   1. Steel Plates, Shapes, and Bars: ASTM A 36, hot dip galvanized.
   2. Steel Pipe: Standard weight steel pipe complying with ASTM A 53.
   3. Cold Formed Steel Tubing: ASTM A 500, Grade A, unless another grade is required by structural loads.
   4. Steel Sheet: ASTM A 1011.

5. Steel Mechanical Tubing: Cold rolled, electric resistance welded carbon or alloy steel tubing complying with ASTM A 513 or steel tubing fabricated from steel complying with ASTM A 569 and complying with the dimensional tolerances in ASTM A 500.
6. Malleable Iron Castings: ASTM A 47, grade required by structural loads.
7. Support Cable: 1/4 inch diameter, 7 x 19 galvanized steel aircraft cable with breaking strength of 7000 lb. Provide fittings complying with cable manufacturer's written recommendations for size, number, and method of installation.
8. Support Chain and Fittings: For chains used for overhead lifting, provide Grade 80 heat-treated alloy steel chains, complying with ASTM A 391, with commercial-quality, hot-dip galvanized or zinc plated steel connectors and hangars. Provide fittings complying with chain manufacturer's written recommendations for size, number and method of installation.
9. General-Purpose Chain: For chains not used for overhead lifting, provide carbon steel chain, complying with ASTM A 413, Grade 30 proof coil chain or other grade recommended by gymnasium equipment manufacturer. Provide coating type, chain size, number, and installation method complying with manufacturer's written instructions.

C. Composite Wood Products: Products shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Wood Based, Structural Use Panels and Softwood Plywood: Comply with DOC PS 2; for plywood comply with DOC PS 1, exterior.

E. Particleboard: ANSI A208.1 made with binder containing no urea formaldehyde.

F. Equipment Wall-Mounted Board: Wood or neutral-color-painted finish, size, and quantity as required to mount gymnasium equipment according to manufacturer's written instructions.

G. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard corrosion-resistant or non-corrodible units; concealed, tamperproof, vandal- and theft-resistant design.

H. Grout: Non-shrink, non-metallic, pre-mixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout, complying with ASTM C 1107 with minimum strength recommended in writing by gymnasium equipment manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for play court layout, alignment of mounting substrates, installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.
1. Verify critical dimensions.
2. Examine supporting structure including subgrades, subfloors, and footings below finished floor.
3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements are clearly marked. Locate reinforcements and mark locations.

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

3.2 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written installation instructions and competition rules indicated for each type of gymnasium equipment. Complete equipment field assembly where required.

B. Unless otherwise indicated, install gymnasium equipment after other finishing operations, including painting, are completed.

C. Permanently Placed Gymnasium Equipment and Components: Install rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated; in proper relation to adjacent construction; and aligned with court layout.
1. Floor Insert Location: Coordinate location with application of game lines and markers, and core drill floor for inserts after game lines are applied.
2. Floor Insert Elevation: Coordinate installed heights of floor insert with installation and field finishing of finish flooring and floor-plate type.
3. Operating Gymnasium Equipment: Verify clearances for movable components of gymnasium equipment throughout entire range of operation and for access to operating components.

D. Floor Insert Setting: Position sleeve in oversized, recessed voids in concrete slab. Clean voids of debris. Fill void around sleeves with grout, mixed and placed to comply with grout manufacturer's written instructions. Protect portion of sleeve above subfloor and footing from splatter. Verify that sleeves are set plumb, aligned, and at correct height and spacing; hold in position during placement and finishing operations until grout is sufficiently cured. Set insert so top surface of completed unit is flush with finished flooring surface.

E. Wall, Corner and Column Safety Pads: Mount with bottom edge at dimension indicated on Drawings above finished floor.

F. Cut-out Trim: Limit cuts in face of padding from trim unit's corner-to-corner outside dimensions. Install with ends of cuts concealed behind trim flange.

G. Anchoring to In-Place Construction: Use anchors and fasteners where necessary to secure built-in and permanently placed gymnasium equipment to structural support and to properly transfer load to in-place construction.

H. Connections: Connect electric operators to building electrical system.

I. Removable Gymnasium Equipment and Components: Assemble in place to verify that equipment and components are complete and in proper working order. Instruct Owner's designated personnel in properly handling, assembling, adjusting, disassembling, transporting, storing, and maintaining units. Disassemble removable gymnasium equipment after assembled configuration is approved by both Architect and Owner, and store units in location(s) indicated by Owner.

3.3 ADJUSTING

A. Adjust movable components of gymnasium equipment to operate safely, smoothly, easily, and quietly, free from binding, warp, distortion, non-alignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and moving parts.

3.4 CLEANING AND PROTECTION

A. After completing gymnasium equipment installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.

B. Provide final protection and maintain conditions acceptable to manufacturer and Installer that ensure gymnasium equipment is without damage or deterioration at time of Substantial Completion.

C. Replace gymnasium equipment and finishes that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gymnasium equipment. Refer to Division 01 Sections PROJECT CLOSEOUT PROCEDURES and DEMONSTRATION AND TRAINING..

END OF SECTION 11 6623

SECTION 12 2400 - WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior manual roller shades.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.03 REFERENCE STANDARDS

A. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2015.

C. UL (GGG) - GREENGUARD Gold Certified Products; current listings at http://http://productguide.ulenvironment.com/QuickSearch.aspx.

D. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

E. WCMA A100.1 - Safety of Corded Window Covering Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of affected installers.

B. Sequencing:

1. Provide a mock-up room in its entirety. Do not proceed with remaining work until mock-up is accepted by Architect and Owner.
2. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.
3. Do not install shades until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, installation and maintenance instructions, and accessories.

B. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.

C. Source Quality Control Submittals: Provide test reports indicating compliance with specified fabric properties.

D. Selection Samples: Include fabric samples in full range of available colors and patterns.

E. Verification Samples: Minimum size 6 inches square, representing actual materials, color and pattern.

F. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.

H. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

I. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

J. Maintenance contracts.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

B. Installer Qualifications: Company specializing in performing work of this type with minimum five years of documented experience with shading systems of similar size and type.

1. Manufacturer's authorized representative.
2. Factory training and demonstrated experience.

C. NFPA Flame-Test: Passes NFPA 701. Materials tested shall be identical to products proposed for use.

1.07 MOCK-UP

A. Mock-Up: Provide a mock-up room in its entirety with full size window shade systems complete with selected shade fabric including example of seams and batten pockets when applicable.

1. Obtain Architect's and Owner's approval of light and privacy characteristics of fabric prior to fabrication.

2. Approved full-sized mock-up may become part of the final installation.
3. Do not proceed with remaining work until mock-up is accepted by Architect and Owner.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver window shades until building is enclosed and construction within spaces where shades will be installed is substantially complete.

B. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.

C. Handle and store shades in accordance with manufacturer's recommendations.

1.09 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits including but not limited to ambient temperature, humidity and ventilation conditions are maintained at levels recommended for project upon completion.

1.10 WARRANTY

A. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
1. Mounting Hardware, Headbox, Rollers, Roller-Coupling Assemblies and Clutch: Twenty-Five (25) years.
2. Spring assist mechanism used in any window treatment product: Ten (10) years.
3. PVC-Free Fabric: Five (5) years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Interior Manually Operated Roller Shades: Manually operated, vertical roll-up, fabric window shade with components necessary for complete installation:
1. Draper, Inc; Clutch Operated FlexShade: www.draperinc.com/#sle.
2. Hunter Douglas Architectural; RB500 Manual Roller Shades: www.hunterdouglasarchitectural.com/#sle.
3. MechoShade Systems LLC; Mecho/5 System: www.mechoshade.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ROLLER SHADES

A. General:
1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
2. Provide shade system that operates smoothly when shades are raised or lowered.

B. Roller Shades
1. Draper, Inc; Clutch Operated FlexShade: www.draperinc.com/#sle.
2. Description: Double roller, manually operated fabric window shades.
a. Drop Position: Regular roll, from back of roller.
b. Mounting: Ceiling mounted.
c. Size: As indicated on drawings.
d. Fabric: As indicated under Shade Fabric article.
3. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
a. Material: Steel, 1/8 inch thick.
b. Double Roller Brackets: Configured for light-filtering and room-darkening shades in one opening.
1) Light-Filtering Fabric: Room-side of opening.
2) Room-Darkening Fabric: Glass-side of opening.
4. Roller Tubes:
a. Material: Extruded aluminum.
b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
1) Minimum Diameter: 1-1/2 inch
c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
d. Roller tubes to be capable of being removed and reinstalled without affecting roller shade limit adjustments.
5. Hembars: Designed to maintain bottom of shade straight and flat.
a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
6. Clutch Operator: Manufacturer's standard material and design integrated with bracket/brake assembly.

a. Provide a permanently lubricated brake assembly mounted on a oil-impregnated hub with wrapped spring clutch.
b. Brake must withstand minimum pull force of 50 pounds in the stopped position.
c. Mount clutch/brake assembly on the support brackets, fully independent of the roller tube components.

7. Drive Chain: Continuous loop stainless steel beaded ball chain, 95 pound minimum breaking strength. Provide upper and lower limit stops.
   a. Chain Retainer: Chain tensioning device complying with WCMA A100.1.
8. Accessories:
   a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; baked enamel finish.
      1) Color: As Selected by Architect from Manufacturer's Full Range.
      2) Profile: Square.
      3) Configuration: Continuous, fascia extends past continuous bracket. Endcaps with fascia designed for surface mounting of dual roller window shades.
         (a) Endcaps: 1028 steel stamping.
         (b) Fascia: L-shaped cover of extruded aluminum, .060 wall. Assembly snaps onto endcaps without exposed fasteners.
         (c) Size: 4-3/4 inches deep by 7 inches high x length required by window opening.
   b. Fasteners: Non-corrosive, and as recommended by shade manufacturer.
   c. Rescue Window Decals

2.03 SHADE FABRIC

A. Fabric for Light-Filtering Shades: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
   1. Manufacturers:
      a. Mermet Corporation; GreenScreen Revive - 1%: www.mermetusa.com/#sle.
   2. Material: Woven PVC-free polyester containing 89 percent recycled content.
   3. Material Certificates and Product Disclosures:
      a. Low-Emitting Material Certification: Greenguard Gold certified and listed in UL (GGG).
      b. Cradle to Cradle Material Health Certificate: Achievement level of Bronze.
      c. Health Product Declaration (HPD): Complete, published declaration with full disclosure of known hazards.
   4. Performance Requirements:
      a. Flammability: Pass NFPA 701 large and small tests.
      b. Fungal Resistance: No growth when tested according to ASTM G21.
   5. Openness Factor: 1%.
   6. Weight: 5.87 ounces per square yard.
   7. Roll Width: 118 inches.
   8. Color: As selected by Architect from manufacturer’s full range of colors.
   9. Fabrication:
      a. Fabric Orientation: Railroaded, fabric is turned 90 degrees off the roll.

B. Fabric for Room-Darkening Shades: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
   1. Manufacturers:
      a. Phifer, Inc; Style 7000 Blackout: www.phifer.com/#sle.
   2. Material: Polyester with acrylic backing
   3. Material Certificates and Product Disclosures:
      a. Low-Emitting Material Certification: Greenguard Gold certified and listed in UL (GGG).
      b. Cradle to Cradle Material Health Certificate: Achievement level of Bronze.
      c. Health Product Declaration (HPD): Complete, published declaration with full disclosure of known hazards.
   4. Performance Requirements:
      a. Flammability: Pass NFPA 701 large and small tests.
      b. Fungal Resistance: No growth when tested according to ASTM G21.
   5. Openness Factor: Opaque.
   6. Weight: 13.92 ounces per square yard.
   7. Roll Width: 118 inches.
   8. Color: As selected by Architect from manufacturer’s full range of colors.

9. Fabrication:
    a. Fabric Orientation: Railroaded, fabric is turned 90 degrees off the roll.

2.04 ROLLER-SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
    1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.
    2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:
    1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
    2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

C. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

3.04 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

3.05 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.

B. Training: Train Owner's personnel on operation and maintenance of system.
    1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
    2. Provide minimum of two hours training by manufacturer's authorized personnel at location designated by the Owner.

3.06 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.07 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

END OF SECTION

SECTION 12 3200 - MANUFACTURED WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Standard and Custom casework, with cabinet hardware.

B. Special purpose units - science and music casework.

1.02 RELATED REQUIREMENTS

A. Section 01 6000 - Product Requirements: Requirements for sustainably harvested wood.

B. Section 06 1000 - Rough Carpentry: Blocking and nailers for anchoring casework.

C. Section 07 9200 - Joint Sealants: Sealing joints between casework and countertops and adjacent walls, floors, and ceilings.

D. Section 12 3600 - Countertops: Additional requirements for countertops.

1.03 DEFINITIONS

A. Exposed: Portions of casework visible when drawers and cabinet doors are closed, including end panels, bottoms of cases more than 42 inches above finished floor, tops of cases less than 72 inches above finished floor and all members visible in open cases or behind glass doors. Consider top of casework as exposed when viewable from above.

B. Semi-Exposed: Portions of casework and surfaces behind solid doors, tops of cases more than 72 inches above finished floor and bottoms of cabinets more than 30 inches but less than 42 inches above finished floor.

C. Concealed: Sleepers, web frames, dust panels and other surfaces not generally visible after installation and cabinets less than 30 inches above finished floor.

1.04 REFERENCE STANDARDS

A. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.

C. ASTM C1036 - Standard Specification for Flat Glass; 2011.

D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

E. AWI (QCP) - Quality Certification Program; current edition at www.awiqcp.org.

F. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

G. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2009.

H. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.05 ADMINISTRATIVE REQUIREMENTS

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

B. Keying Conference: Conduct conference prior to ordering locks and keys. Incorporate conference decisions into keying submittal.

1.06 SUBMITTALS

A. Product Data: Component dimensions, configurations, construction details, joint details, attachments; manufacturer's catalog literature on hardware, accessories, and service fittings, if any. Locate hardware and locks, and provide keying arrangements.

B. Shop Drawings: Indicate casework types, sizes, and locations, using large scale plans, elevations, and cross sections. Include rough-in and anchors, reinforcements, and blocking, placement dimensions and tolerances, clearances required, and utility locations, if any.

1. Copies of Architect’s Drawings, manufacturer’s standard details or other non-project-specific details are not acceptable, and will be returned without review.
2. Verify dimensions by field measurements before fabrication and indicate on shop drawings.
3. Where it is infeasible to verify field dimensions prior to generating shop drawings, include letter from contractor responsible for surrounding construction stating specific reasons that field dimensions are not available, and certifying that the finished surrounding construction shall conform to the dimensional requirements and installation tolerances indicated on the shop drawings. That contractor shall become solely responsible for modifications to new or existing work required to accommodate installation per the shop drawings, to the satisfaction of the Architect, and at no additional cost to the Owner.

C. Selection Samples: Where product specific color, pattern, or texture is indicated, proposed products of other manufacturers must be available in adequately matching color, pattern, and texture, at the sole discretion of the Architect.
   1. For each type where color selection is not indicated or proposed material varies from Basis-of-Design, provide two sets of color chips representing proposed manufacturer's full range of available colors, patterns, and textures.
   2. Do NOT submit color samples of products submitted per Basis-of-Design.
   3. Where other non-basis-of-design manufacturers are listed without colors, they may be considered of like quality, but is not meant to imply that those manufacturer's offer adequately matching products for all types required.

D. Casework Samples: Representative of types in the project.
   1. Base Cabinet: Cabinet with drawer and door and specified hardware.
   2. Tall Cabinet: Cabinet with shelves and supports, door and specified hardware.
   3. Wall Cabinet: Cabinet with shelves and supports, door and specified hardware.
   4. Specialty Cabinet: As indicated on drawings. Cabinet with door and specified hardware. Type indicated on drawings.

E. Manufacturer's Installation Instructions.

F. Maintenance Data: Manufacturer's recommendations for care and cleaning.

G. Finish touch-up kit for each type and color of materials provided.

1.07 QUALITY ASSURANCE

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

B. Quality Certification: Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section.
   1. Provide labels or certificates indicating that the installed work complies with AWMAC/WI (NAAWS) requirements for grade or grades specified.
   2. Provide designated labels on shop drawings as required by certification program.
   3. Provide designated labels on installed products as required by certification program.
   4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
   5. Replace, repair, or rework all work for which certification is refused.

C. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than five years of documented experience and approved by manufacturer.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect items provided by this section, including finished surfaces and hardware items during handling and installation. For metal surfaces, use polyethylene film or other protective material standard with the manufacturer.

B. Acceptance at Site:
   1. Do not deliver or install casework until the conditions specified under Part 3, Examination Article of this section have been met. Products delivered to sites that are not enclosed and/or improperly conditioned will not be accepted if warping or damage due to unsatisfactory conditions occurs.

C. Storage:
   1. Store casework in the area of installation. If necessary, prior to installation, temporarily store in another area, meeting the environmental requirements specified under Part 3, "Site Verification of Conditions" Article of this section.

1.09 MOCK-UPS

A. Provide full size base cabinet and upper cabinet complete with drawers, door, adjustable shelf and countertop.

B. See Section 01 4000 - Quality Requirements for additional requirements.

C. Locate where directed.

D. Approved Mock-up may remain as part of the Work.

1.10 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion, at no additional cost to Owner. Defects include, but are not limited to:
   1. Ruptured, cracked, or stained finish coating.
   2. Discoloration or lack of finish integrity.
   3. Cracking or peeling of finish.
   4. Delamination of components.

5. Failure of adhesives.
6. Failure of hardware.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Plastic Laminate Casework:
   1. Case Systems: www.casesystems.com/#sle.
   2. Wood-Metal Industries: www.wood-metal.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Music Casework: Note: Wenger cabinets and tags are shown in the drawings for product type and storage capacties.
   1. Basis of Design: Case Systems: www.casesystems.com/#sle.
   2. Wenger Corporation: www.wengercorp.com
   3. Substitutions: See Section 01 6000 - Product Requirements.

C. Obtain casework from single source and manufacturer, unless otherwise indicated.

2.02 CASEWORK, GENERAL

A. Quality Standard: AWMAC/WI (NAAWS), unless noted otherwise.

B. Types: More than one type is required. See drawings for location of each type of casework.

C. Wood Veneer Faced Cabinets: Custom Grade.

D. Plastic Laminate Faced Cabinets: Custom Grade.

2.03 FABRICATION

A. Assembly: Shop assemble casework items for delivery to site in units easily handled and to permit passage through building openings.

B. Construction: As required for selected grade, and not less than indicated elsewhere in this section.

C. Structural Performance: Safely support the following minimum loads:
   1. Base Units: 500 pounds per linear foot across the cabinet ends.
   2. Suspended Units: 300 pounds static load.
   3. Drawers: Heavy Duty - 100 pounds static load.
   4. Hanging Wall Cases: 300 pounds.
   5. Shelves: 100 pounds, minimum.

D. Glazing for Doors: Clear tempered glass.
   1. Glazing: With gaskets and removable stops; minimize rattling and vibration.

E. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

F. Scribes and Fillers: Panels of matching construction and finish, for locations where cabinets do not fit tight to adjacent construction.

G. Sloped tops for wall and floor cabinets: With closed ends, of matching construction and finish. Concealed anchorages for attachment to cabinet(s) below.

H. Apron Frames: Construction similar to other cabinets, with modifications.
   1. Frames fabricated from panels standard with the manufacturer. Include front and back panels, with drawer suspension framing mechanically fastened to support channels spanning between them.

2.04 PLASTIC-LAMINATE-CLAD CASEWORK

A. Plastic-Laminate-Clad Casework: Solid wood and wood panel construction; each unit self-contained and not dependent on adjacent units or building structure for rigidity; in sizes necessary to avoid field cutting except for scribes and filler panels.
   1. Style: Flush overlay. Ease doors and drawer fronts slightly at edges.
   2. Cabinet Nominal Dimensions: Unless otherwise indicated, provide cabinets of widths and heights indicated on drawings, and with following front-to-back dimensions:
      a. Base Cabinets: 24 inches.
      b. Tall Cabinets: 22 inches.
      c. Wall Cabinets: 13 inches.
   3. Construction:
      a. End Panels: 3/4 inch particleboard with HPDL on exposed faces and thermo-fused melamine on remaining face(s). Finish exposed edge with.018 inch edge treatment.

b. Bottoms at Base Cabinets: 3/4 inch particleboard with thermo-fused melamine faces, bored, doweled, and glued to end panels. Finish exposed edge with.018 inch edge treatment.

c. Bottoms and Tops of Wall Cabinets: 1 inch particleboard with HPDL on exposed face(s) and thermo-fused melamine on remaining face(s), bored, doweled, and glued to end panels. Finish exposed edge with.018 inch edge treatment.

d. Horizontal Top Frame: 3/4 inch thick by 4 inch wide particleboard with thermo-fused melamine faces, plywood, or solid hardwood, front and back. For cabinets over 36 inches wide provide four-sided frame, with doweled and glued corners. Top frame shall be bored, doweled, and glued to end panels. Finish exposed edge with.018 inch edge treatment.

e. Intermediate Rails: 3/4 inch thick by 4 inch wide particleboard with thermo-fused melamine faces, plywood or solid hardwood, bored, doweled, and glued to end panels. Finish exposed edge with.018 inch edge treatment.
   1) Where locked drawers are indicated, and keyed differently, provide rails matching top frame construction between drawers, with 1/4 inch thick hardboard separators installed in dadoes.
      (a) Option: 3/4 inch particleboard with thermo-fused melamine faces, bored, doweled, and glued to end panels. Finish exposed edge with.018 inch edge treatment.

f. Exposed Backs: 1/2 inch thick particleboard with HPDL face and thermo-fused melamine back, captured in dado each side, and mechanically fastened to top frame. Back shall be further attached to end panels with multiple glue blocks or continuous bead of hot-melt adhesive.
   1) Option: 3/4 inch thick particleboard, bored, doweled, and glued to end panels, and mechanically fastened to top frame.

g. Unexposed Backs: 1/4 inch minimum thickness hardboard with thermo-fused melamine face, attached same as exposed backs.
   1) Where removable backs or other access panels are required provide construction similar to exposed back, with factory cut opening as large as possible, with permanently installed cleats on all four sides. Provide tightly fitting removable panel, fastened with screws and trim washers. In sink base cabinets top of panel shall not extend behind sink. In wet areas finish cut edges of panel and opening.

h. Fixed Shelves: 3/4 inch veneer core plywood with HPDL faces, bored, doweled, and glued to end panels, and mechanically fastened to back panel. Finish exposed edge with 3mm edge treatment.

i. Adjustable Shelves: HPDL both faces, with 3mm edge treatment on front and back edges, on the following core options:
   1) Spans up to 35 inches: 3/4 inch veneer core plywood, 7 plies, MoE: 750,000.
   2) Spans up to 35 inches: 3/4 inch particleboard, MoE: 710,000.
   3) Spans up to 42 inches: 1 inch veneer core plywood, 11 plies, MoE: 750,000.
   4) Spans up to 42 inches: 1 inch particleboard, MoE: 710,000.
   5) Spans up to 42 inches: 3/4 inch hardwood veneer core plywood, 13 plies, MoE: 1,000,000.
   6) Spans up to 48 inches: 1 inch hardwood veneer core plywood, 17 plies, MoE: 1,000,000.
   7) Spans over 48 inches: Not allowed.

j. Flush Doors up to 84 inches tall and 24 inches wide: 3/4 inch particleboard core with HPDL applied to both faces. Doors larger in either dimension shall be similarly constructed, to 1-1/16 inch thickness minimum. Finish exposed edges with 3mm edge treatment.

k. Framed Doors for glazing, up to 48 inches tall: 2-1/4 inches wide by 3/4 inch thick solid hardwood stiles and rails with tenoned and glued corners, with HPDL faces. Taller doors shall be similarly constructed, to 1-1/16 inch thickness. Finish exposed edges with 3mm edge treatment.

l. Glazing: 1/4" thick tempered safety glass, unless otherwise indicated.

m. Tackable Surface: Door panel shall have recess machined into it to create 2-1/4" border, and allow tack surface to be flush with or slighly proud of finished door surface. Tack panel shall be seamless, self-healing linoleum, similar and equal to Forbo bulletin board, 1/4 inch thick, fully adhered in recess with manufacturer's recommended adhesive.

n. Drawer Fronts: 3/4 inch particleboard with HPDL applied to both faces. Finish exposed edges with 3mm edge treatment. Provide false drawer fronts for application at sink bases unless otherwise indicated.

o. Drawer Boxes:
   1) Front, back, and sides: 1/2 inch thick solid hardwood lumber or 1/2 inch hardwood veneer core plywood (ApplePly or Baltic Birch, 9-ply minimum) of height filling the opening to the greatest extent possible, while remaining fully functional. Sides shall have smooth, slightly radiused top edge. No edge banding is required. Boxes shall be assembled with dovetailed construction on all corners.
   2) Bottoms: 1/2 inch hardwood veneer core plywood matching sides or 1/2 inch melamine-faced hardboard, captured in dado all four sides and further secured with a continuous bead of hot-melt adhesive on bottom. Omit adhesive that interferes with hardware. Particleboard, metal or plastic drawer boxes or bottoms are not acceptable.
   3) Finish wood components with two coats of clear varnish per Shop Finishing section above.

p. Separate Subbases: 3/4 inch thick water resistant plywood, constructed to form ladder-syle base full width of cabinet, and depth as required to form 2 inch recessed toekick at front face. At exposed ends hold back 1/4 inch to form recess for application of base indicated.

1) Where base is required to be open for ventilation, construct pallet-style base, open front and back, with ventilated front as indicated.

4. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline.
   a. Finish: Matte or suede, gloss rating of 5 to 20.
   b. Surface Color and Pattern: As indicated on drawings.
   c. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
5. Exposed Edge Treatment: ABS edge banding Flat with Eased Edge profile, in thickness indicated, by full finished edge width of panel.
   a. Manufacturers:
      1) Wilsonart: www.wilsonart.com.
      2) Dollken: www.na.doellken.com.
      3) Rehau : www.rehau.com/us-en
      4) Other manufacturers demonstrating compliance with Specifications and Basis-of-Design product.

2.05 COUNTERTOPS

A. Countertops: See Section 12 3600.

2.06 SPECIAL PURPOSE UNITS

A. Musical Instrument and Sheet Music Storage Special Units.
   1. Basis of Design Manufacturer: Case Systems.
   2. Style: Music Instrument Storage Full Grille Doors and Adjustable Shelves.
      a. Adjustable Shelf Quantity: 5 per unit.
   3. Style: High Density Sheet Music Storage 'SM-1' On Drawings. See plans and elevations for configuration
   4. Primary Construction: Plastic-laminate clad units.
      a. Design: Modular units with through-bolted fastening for reconfigurable assembly.
   5. Sizes and Types: As indicated on drawings
      a. Finish, Surface Color and Pattern: As selected by Architect from manufacturer's full line.

2.07 CABINET HARDWARE

A. Locks: Provide locks on casework drawers and doors where indicated. Lock with 5 pin cylinder and 2 keys per lock.
   1. Hinged Doors (Single): Single retractable cam type lock, mounted to interior surface. Provide strike-plate as required by cabinet construction. Product shall be similar and equal to Timberline 240 series Door Lock by CompX Security Products; www.compx.com, 625 finish.
   2. Hinged Doors (Double): Double retractable cam type lock, mounted to interior surface, locking two adjacent doors without the need for a separate catch on the opposite door. Provide strike plates as required by cabinet construction. Product shall be similar and equal to Timberline 250 series Double Door Lock by CompX Security Products; www. compx.com, 625 finish
   3. Tall Hinged Doors: Three-point latching system.
   4. Provide removable core system with control key for re-keying of locks without removal of lock body.
      a. Provide manufacturer's standard re-keying kit.
   5. Keying: Key locks alike within a space; key each room separately.
   6. Master Key System: All locks operable by master key.

B. Shelves in Cabinets:
   1. Shelf Supports: Double pin (5mm), heavy duty, clear plastic shelf supports for 32mm hole spacing, with hold-down tabs for 3/4 inch and 1 inch thick shelves.

C. Swinging Doors: Hinges, pulls, and catches.
   1. Hinges: Semi-concealed, number as required by referenced standards for width, height, and weight of door.
      a. Semi-Concealed Hinges: Installed as required by hinge design, bright chromium plated over nickel on base material.
         1) Butt hinges installed on cabinet edge, and on door back for overlay doors; five-knuckle, projecting barrel, minimum 2-1/2 inches long; stainless steel, No.4 finish.
      b. Concealed Hinges: Installed in cabinet edge, and on door back, bright chromium plated over nickel on base material.
         1) European-Style Hinges for Overlay Doors: 110 degree opening angle.
         2) Provide "soft close" feature built into hinge mechanism.
         3) Provide products with manufacturer's name or unique brand marking stamped on hinges for identification purposes.
   2. Pulls: Chrome wire pulls, 4 inches wide.

3. Catches: Mechanical catch.

D. Drawers: Pulls and slides.
   1. Pulls: Chrome wire pulls, 4 inches wide.
   2. Slides: Steel, full extension arms, ball bearings; self-closing; capacity as recommended by manufacturer for drawer height and width, but not less than 100 pounds.
   3. Slides: Single extension, bottom mounted, epoxy powder coated steel, ball-bearing nylon roller, with positive in stop, out stop and out keeper, lift out disconnect, stay-closed design.

2.08 MATERIALS

A. Adhesives Used for Assembly: Comply with VOC requirements for adhesives and sealants; see Section 01 6116.

B. Wood-Based Materials:
   1. Certified as sustainably harvested; see Section 01 6000.
   2. Solid Wood: Air-dried to 4.5 percent moisture content, then tempered to 6 percent moisture content before use.
   3. Composite Wood Panels: Containing no urea-formaldehyde resin binders.

C. Solid Wood: Clear, dry, sound, plain sawn, selected for well-matched species, grain and color, no defects.

D. Semi-Exposed Solid Wood: Dry, sound, plain sawn, no appearance defects, any species similar in color and grain to exposed portions.

E. Hardwood Plywood: Veneer core; HPVA HP-1 Grade as indicated; same species as exposed solid wood, clear, compatible grain and color, no defects. Band exposed edges with solid wood of same species as veneer.

F. Hardwood Edgebanding: Use solid hardwood edgebanding matching species, color, grain, and grade for exposed portions of cabinetry.

G. Hardboard: ANSI A135.4, Class 1, tempered.

H. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications. complying with Grade requirements, and standard with the manufacturer.

I. Thermally Fused Laminate (TFL): Melamine resin, NEMA LD 3, Type VGL laminate panels.

J. Glass: Fully tempered float; ASTM C1036, Type 1, Quality Q3; ASTM C1048, tempered using horizontal tempering and complying with ANSI Z97.1; 3/16 inch thick minimum; exposed edges ground, and cut or drilled to receive hardware; clear.

2.09 ACCESSORIES

A. Pencil Grilles: 3/4 inch deep linear bar grille with 1/4 inch nominal bar spacing, assembled with weld-lock cross bars. Provide factory mitered corners where continuous grilles change direction.
   1. Basis-of-Design Product: AG series bar grille by Architectural Grille.
   2. Core: AG10.
   3. Material: Aluminum.
   4. Finish: Satin.
   5. Attachment: Provide fastening tabs for screw attachment between bars.
   6. Frame: Type A.
   7. Frame Attachment: Face screws.

B. Perforated Grilles: Flat stock material perforated in manufacturer's standard decorative patterns as indicated.
   1. Basis-of-Design Product: Perforated Grilles by Architectural Grille.
   2. Material: Aluminum.
   3. Thickness: 1/16 inch.
   4. Pattern: 213 Staggered Holes.
   5. Finish: Powder coated.

C. Removable Tray: Storage Tote Tray with Ticket Window Label and Clear Glide & Tilt Runner System
   1. Basis-of-Design Product: CertwoodUSA.
   2. Material: Injection Molded Engeneering Grade ABS
   3. Color: As shown on drawings.
   4. Product: Slim Line
      a. Single Depth: 12 1/4"w x 16 3/4"d x 3"h
      b. Double Depth: 12 1/4"w x 16 3/4"d x 6"h
      c. Quad Depth: 12 1/4"w x 16 3/4"d x 12"h

D. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent surface.

PART 3 EXECUTION

3.01 PREPARATION

A. Large Components: Ensure that large components can be moved into final position without damage to other construction.

3.02 EXAMINATION

A. Site Verification of Environmental Conditions:
   1. Do not deliver casework until the following conditions have been met:
      a. Building has been enclosed (windows and doors sealed and weather-tight).
      b. An operational HVAC system that maintains temperature and humidity at occupancy levels has been put in place.
      c. Ceiling, overhead ductwork, piping, and lighting have been installed.
      d. Installation areas do not require further “wet work” construction.

B. For Base Cabinets Installation: Examine floor levelness and flatness of installation space. Do not proceed with installation if encountered floor conditions required more than 1/2 inch leveling adjustment. When installation conditions are acceptable, for each space, establish the high point of the floor. Set and make level and plumb first cabinet in relation to this high point.

C. For Wall Cabinets Installation: Examine wall surfaces in installation space. Do not proceed with installation if the following conditions are encountered:
   1. Maximum variation from plane of masonry wall exceeds 1/4 inch in 10 ft and 1/2 inch in 20 ft or more, and/or maximum variation from plumb exceeds 1/4 inch per story.
   2. Maximum Variation of finished gypsum board surface from true flatness: 1/8 inch in 10 feet in any direction.

D. Verify adequacy of support framing and anchors.

E. Verify that service connections are correctly located and of proper characteristics.

3.03 INSTALLATION

A. Perform installation in accordance with manufacturer's instructions.

B. Use anchoring devices to suit conditions and substrate materials encountered. Use concealed fasteners to the greatest degree possible. Use exposed fasteners only where allowed by approved shop drawings, or where concealed fasteners are impracticable.

C. Set casework items plumb and square, securely anchored to building structure.

D. Align cabinets to adjoining components, install filler and/or scribe panels where necessary to close gaps.

E. Fasten together cabinets in continuous runs, with joints flush, uniform and tight. Misalignment of adjacent units not to exceed 1/16 inch. In addition, do not exceed the following tolerances:
   1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet.
   2. Variation of Bottoms of Wall Cabinets from Level: 1/8 inch in 10 feet.
   3. Variation of Faces of Cabinets from a True Plane: 1/8 inch in 10 feet.
   4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch.
   5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch.

F. Base Cabinets: Fasten cabinets to service space framing and/or wall substrates, with fasteners spaced not more than 16 inches on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.

G. Install hardware uniformly and precisely.

H. Countertops: Install countertops intended and furnished for field installation in one true plane, with ends abutting at hairline joints, and no raised edges.

I. Replace units that are damaged, including those that have damaged finishes.

3.04 ADJUSTING

A. Adjust operating parts, including doors, drawers, hardware, and fixtures to function smoothly.

3.05 CLEANING

A. Clean casework and other installed surfaces thoroughly.

3.06 PROTECTION

A. Do not permit finished casework to be exposed to continued construction activity.

B. Protect casework and countertops from ongoing construction activities. Prevent workmen from standing on, or storing tools and materials on casework or countertops.

END OF SECTION

SECTION 12 3600 - COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for architectural casework and millwork.
B. Countertops for manufactured casework.
C. Sinks molded into countertops.
D. Epoxy resin sinks.
E. Countertop supports and brackets.
F. Window Stools

1.02 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2009.
B. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2009.
C. ASTM D792 - Standard Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement; 2013.
D. AWI (QCP) - Quality Certification Program; current edition at www.awiqcp.org.
E. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
F. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.
G. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
H. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
I. PS 1 - Structural Plywood; 2009.
J. SEFA 3 - Work Surfaces; 2010.

1.03 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.
B. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.
   1. Copies of Architect’s Drawings, manufacturer’s standard details or other non-project-specific details are not acceptable, and will be returned without review.
   2. Verify dimensions by field measurements before fabrication and indicate on shop drawings.
   3. Where it is infeasible to verify field dimensions prior to generating shop drawings, include letter from contractor responsible for surrounding construction stating specific reasons that field dimensions are not available, and certifying that the finished surrounding construction shall conform to the dimensional requirements and installation tolerances indicated on the shop drawings. That contractor shall become solely responsible for modifications to new or existing work required to accommodate installation per the shop drawings, to the satisfaction of the Architect, and at no additional cost to the Owner.
C. Selection Samples: Where product specific color, pattern, or texture is indicated, proposed products of other manufacturers must be available in adequately matching color, pattern, and texture, at the sole discretion of the Architect.
   1. For each type where color selection is not indicated or proposed material varies from Basis-of-Design, provide two sets of color chips representing proposed manufacturer's full range of available colors, patterns, and textures.
   2. Where other non-basis-of-design manufacturers are listed without colors, they may be considered of like quality, but is not meant to imply that those manufacturer's offer adequately matching products for all types required.
D. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
E. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
F. Installation Instructions: Manufacturer's installation instructions and recommendations.
G. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than ten years of documented experience.

B. Quality Certification:
   1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
   2. Provide labels or certificates indicating that the installed work complies with AWMAC/WI (NAAWS) requirements for grade or grades specified.
   3. Provide designated labels on shop drawings as required by certification program.
   4. Provide designated labels on installed products as required by certification program.
   5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.06 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 COUNTERTOPS

A. Quality Standard: Custom Grade, in accordance with AWMAC/WI (NAAWS), unless noted otherwise.

B. Epoxy Resin Countertops: Filled epoxy resin molded into homogenous, non-porous sheets; no surface coating and color and pattern consistent throughout thickness; with integral or adhesively seamed components.
   1. Manufacturers:
      a. Durcon, Inc., Greenstone: www.durcon.com. (Basis-of-Design)
      b. Prime Industries, Inc: www.piilab.com.
      c. Other manufacturers demonstrating compliance with Specifications and Basis-of-Design product.
   2. Flat Surface Thickness: 1 inch, nominal.
   3. Physical properties; minimum acceptable physical performance in accordance with SEFA 3 testing procedures:
      a. Density/specific gravity: Tested to ASTM D792; minimum test rating of 120 PSF.
      b. Rockwell hardness: Tested to ASTM D785; minimum M scale rating of 105.
      c. Fire resistance: tested to ASTM D635; classified as self-extinguishing.
      d. Surface burning characteristics: Tested to ASTM E84; flame spread index 7.4 and smoke develop index of 221.2.
      e. Surface burning characteristics in vertical position: Tested to ASTM D3801; maximum flame spread index of 7.4 and smoke developed index of 221.2.
      f. Coefficient of linear thermal expansion: Tested to ASTM D696; rating of 2.46 x 10-5.
      g. Heat deflection: Tested to ASTM D648; maximum 205 degrees F or 96 degrees C.
      h. Flexural strength: Tested to ASTM D790; minimum rating 14.9 KPSI or 103 Mpa.
      i. Flexural modulus: Tested to ASTM D790; 2,777,501 PSI or 19.2 Gpa.
      j. Water absorption, 24 hours: tested to ASTM D570; maximum 0.008 percent by weight.
      k. Compression strength: Tested to ASTM D695; minimum 38.4 kpsi or 265 Mpa.
   4. Chemical-Resistance: Provide products that resist the following chemicals with not more than Slight Effect when tested in accordance with NEMA LD 3:
      a. Amyl Acetone
      b. Ethyl Acetate
      c. Acetic Acid 98%
      d. Acetone
      e. Acid Dichromate 5%
      f. Butyl Alcohol
      g. Ethyl Alcohol
      h. Methyl Alcohol
      i. Ammonium Hydroxide, 28%
      j. Benzene
      k. Carbon Tetrachloride
      l. Chloroform

m. Chromic Acid 60%
n. Cresol
o. Dichloro Acetic Acid
p. Dimethylformanide
q. Dioxane
r. Ethyl Ether
s. Formaldehyde 37%
t. Formic Acid 90%
u. Furfural
v. Gasoline
w. Hydrochloric Acid, 37%
x. Hydroflouric Acid 48%
y. Hydrogen Peroxide 28%
z. Tincture of Iodine
aa. Methyl Ethyl Ketone
bb. Methylene Chloride
cc. Mono Chlorobenzene
dd. Napthalene
ee. Nitric Acid, 20%
ff. Nitric Acid, 30%
gg. Nitric Acid, 70%
hh. Phenol 90%
ii. Phosphoric Acid, 85%
jj. Silver Nitrate, Saturated
kk. Sodium Hydroxide, 10%
ll. Sodium Hydroxide, 20%
mm. Sodium Hydroxide, 40%
nn. Sodium Hydroxide, Flake
oo. Sodium Sulfide, Saturated
pp. Sulfuric Acid, 25%
qq. Sulfuric Acid, 85%
rr. Sulfuric Acid, 96%
ss. Sulfuric Acid 85%, and Nitric
tt. Acid 70%, equal parts
uu. Toluene
vv. Trichlorethylene
ww. Xylene
xx. Zinc Chloride, Saturated

5. Surface Finish: Smooth, non-glare.
6. Color: As selected by Architect from Basis-of-Design manufacturer's full range.
7. Back and End Splashes: Same material, same thickness; separate for field attachment.
8. Sinks: Same material, same color; molded in one piece with sloped rabbeted lip sealed to countertop; bottom sloped to outlet; molded outlets; drain outlet located in back corner.
   a. Sides and Ends: 1/2 inch minimum thickness.
   b. Bottoms: 5/8 inch minimum thickness.
   c. Interior Corners: 1 inch minimum radius.
   d. Clamping collars for 1-1/2 or 2 inch diameter waste pipe, for sealed but not permanent connection.
   e. Provide 1-1/2 or 2 inch standpipe overflow, 2 inches shorter than depth of sink
   f. Steel channel supports front to back on each side, fastened to underside of top to support twice full sink weight.
9. Fabricate in accordance with AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.

C. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
   1. Flat Sheet Thickness: 1/2 inch, minimum.
   2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.

a. Manufacturers:
1) Avonite Surfaces: www.avonitesurfaces.com/#sle.
2) Dupont: www.corian.com/#sle.
3) Formica Corporation: www.formica.com/#sle.
4) Wilsonart: www.wilsonart.com/#sle.
5) Other manufacturers demonstrating compliance with Specifications and Basis-of-Design product.
b. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
c. Color and Pattern: As indicated on drawings.
3. Other Components Thickness: 1/2 inch, minimum.
4. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
5. Fabricate in accordance with AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.

2.02 MATERIALS

A. Wood-Based Components:
1. Wood fabricated from old growth timber is not permitted.
2. Provide sustainably harvested wood, certified or labeled; see Section 01 6000 - Product Requirements.
B. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
C. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf minimum density; minimum 3/4 inch thick; join lengths using metal splines.
D. Medium Density Fiberboard for Supporting Substrate: ANSI A208.2.
E. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
F. Joint Sealant: Mildew-resistant silicone sealant, clear.

2.03 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
1. Join lengths of tops using best method recommended by manufacturer.
2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall, and not more than 1/8 inch at appliances.
3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
2. Height: 4 inches, unless otherwise indicated.

2.04 ACCESSORIES

A. Steel Counter Brackets: 1/8 inch thick, powder coated steel brackets, pre-drilled for surface installation.
1. Basis-of-Design Product: A&M Hardware Standard Workstation and Countertop Brackets.
2. Load Capacity: Recommended by manufacturer for loading of 1,400 pounds per pair , minimum.
3. Material: Steel.
4. Lengths: As indicated on drawings.
B. Concealed Steel Counter Brackets: 1/8 inch thick, powder coated steel brackets, pre-drilled for lateral attachment to studs.
1. Basis-of-Design Product: A&M Hardware Concealed Workstation Brackets.
2. Load Capacity: Recommended by manufacturer for loading of 1,800 pounds per pair , minimum.
3. Material: Steel.
4. Lengths: As indicated on drawings.
C. Steel ADA Sink Counter Brackets: 12 gage, steel brackets, in profile to meet required clearances for installation of ADA counter top and removable face panel.
1. Basis-of-Design Product: A&M Hardware ADA Support Brackets.
2. Load Capacity: Recommended by manufacturer for loading of 1,500 pounds per pair , minimum.
3. Material: Steel.
4. Lengths: As indicated on drawings.
D. Pencil Grilles: 3/4 inch deep linear bar grille with 1/4 inch nominal bar spacing, assembled with weld-lock cross bars. Provide factory mitered corners where continuous grilles change direction.
1. Basis-of-Design Product: AG series bar grille by Architectural Grille.
2. Core: AG10.

3. Material: Aluminum.
4. Finish: Satin.
5. Attachment: Provide fastening tabs for screw attachment between bars.
6. Frame: Type A.
7. Frame Attachment: Face screws.

E. Grommets: Plastic grommets, and matching cover plates with integral cord slot.
1. Basis-of-Design: XG Flip-Top Series by Doug Mockett & Company, Inc.
2. Material: Plastic.
3. Color: Black.
4. Shape: Round.
5. Size: 3 inch.
6. Provide one grommet at each workstation, and not less than one grommet every five linear feet of open work surface.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.
B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

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

3.03 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
B. Attach epoxy resin countertops using compatible adhesive.
C. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

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

3.05 CLEANING

A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

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

END OF SECTION

GC/TRADE SUPPORT FOR ELEVATOR INSTALLATION 14 21 50

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE

A. Provide where shown, all materials, labor, services, permits and related work, to provide elevator hoistways, CM & GC support, electrical, mechanical, fire protection and fire alarm support to enable completion of a complete, operating, tested, functioning, documented elevator system including all work shown, specified or required.

B. The Construction Manager shall arrange an on-site storage area for elevator equipment. The area shall be dry and enclosed within the building. Space will provide rollable access to the elevator hoistway at ground level, adjacent to the hoistway.

C. The General Contractor shall provide on-site refuse containers for disposal of elevator packing material and Elevator Contractor refuse.

D. The General Contractor shall provide cut-outs to accommodate elevator equipment and patching/painting of walls, floors or partitions in the hoistway and control room.

E. The General Contractor shall provide finished flooring material in elevator cars.

F. The General Contractor shall provide painting of areas surrounding entrance frames.

G. The Elevator Contractor shall provide guarding and protection of the public and workers from the project site and hoistway during construction. The Elevator Contractor shall provide additional barricades for the protection of workers when the Elevator Contractor is on site.

H. The Electrical Contractor shall provide a permanent light fixture in elevator pit together with a GFCI outlet and an appropriate switch.

I. The Electrical Contractor shall provide a fire alarm system interface with suitable relays for Phase 1 and Phase 2 recall and contact for fireman's hat.

J. The Electrical Contractor shall provide 208Y/120V, 3-phase circuits for machines and separate 120V, 1-phase circuits for car lights/fans. All circuits shall have full-sized ground conductor.

PART 2 - PRODUCTS

2.1 ELEVATOR CAR FLOORING

A. GC to provide flooring in elevator car as per Architect.

PART 3 - EXECUTION

3.1 DELIVERY OF TOOLS, MATERIALS AND EQUIPMENT

A. The Contractor shall assume responsibility and all costs associated with the delivery and removal of all materials and equipment. The Contractor shall furnish all trucking, rigging, and transportation for all items required to complete the project. In addition, the Contractor shall accept responsibility to protect the grounds, building, and building contents during associated deliveries and removals.

3.2 BARRICADES

A. Solid barricades shall completely enclose entrances to the shaft from the public and shall have a keyed locked entrance on each floor. Each barricade shall completely contain all portions of the project for each individual landing to a height of not less than 8′-0″ or to the ceiling. At no time shall the barricades be removed prior to the installation of fully functional safety interlocks, and installation of walls. At no time shall any entrance be left open to any elevator shaft. Contractors shall comply with any and all Occupational Safety and Health Standards for general industry (26 CFR 1911) and for the Construction Industry (29 CFR 1926). Special attention shall be addressed to sections 1926.502 Personal Fall Arrest Systems and especially 1926.502(d)(ii) regarding work in Elevator Shafts by all persons working inside the guarded areas. The Contractor shall be required to show documentation that each person who has access to the elevator entrances has been trained in the proper use of personal fall protection. The Owner reserves the right to require additional safety precautions at any time. A copy of the “Elevator Industry Field Employee’s Safety Handbook” shall be required on the site at all times and an additional copy shall be provided to the Owner along with a job specific safety program prior to the beginning of any work. Perform work at all times in accordance with the minimum requirements of the “Elevator Industry Field Employee’s Safety Handbook,” published by Elevator World.

3.3 PROTECTION

A. Temporary Use: Do not use an elevator for construction purposes unless cars are provided with temporary enclosures, either within finished cars or in place of finished cars, to protect finishes from damage.

END OF SECTION 14 21 50

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This section includes the following:

1. Provide, install, start-up, test, maintain until final acceptance and maintain for one year following final acceptance, complete, operating, documented hydraulic elevator installation as specified herein and shown on the Contract Drawings.

a. Provide modernization of one (1) existing hole-less hydraulic elevator including elevator controller, door operator, door locks, and associated door equipment.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each elevator shall include capacities, sizes, performances, operations, safety features, controls, finishes, and similar information.

C. Shop drawings for each elevator showing plans, elevations, sections, and large-scale details indicating service at each landing, coordination with building structure, and relationships with other construction. Indicate variations from specified requirements, maximum dynamic and static loads imposed on building structure at points of support, and location of signals. Include maximum and average power demands.

D. Maintenance manuals for each different hydraulic elevator, including operation and maintenance instruction, parts listing with sources indicated, recommended parts inventory listing, emergency instruction, and similar information. Include all diagnostic and repair information available to manufacturers and installer's maintenance personnel. Submit for Owner's information at project closeout as specified in Division 1.

E. Inspection and acceptance certificates and operating permits as required by governing authorities for normal, unrestricted elevator use.

F. Color and material selection chart for all Architect selected furnishes.

G. Submit welding certificates for all personnel performing field welding.

H. Submit warranty certificate from manufacturer and guarantee from Contractor.

1.4 SPECIFICATION INTENT

A. It is the intent of the Specification to provide hydraulic elevators which conform to Sauquoit Valley Central School District (SVCSD) Standards in terms of keying, car accessories and maintainable parts. The standard offering of an elevator vendor shall be considered acceptable so long as the furnished materials meet the Owner standards for keying and replaceable parts, and the unit can be fully maintained and adjusted by third parties. The above shall be interpreted to include all annual and 5-year inspection tests as required by the AHJ. The vendor shall also agree to provide the sale of replacement and/or spare parts directly to the Owner's designated maintenance contractor.

B. By submission of this bid, Contractor agrees that any and all equipment, devices, software, etc., shipped from the factory with the elevator, or installed in the field during construction, shall remain on the unit regardless of the execution of a continuing maintenance agreement with the Owner. Contractor shall not remove any component part, software module, license, etc. from the equipment at the expiration of the warrantee period. Intellectual property of the manufacturer shall remain the ownership of the manufacturer at all times, and the Owner agrees to prohibit release of any such property to third parties without the consent of the manufacturer.

1.5 APPLICABLE CODES

A. Facilities to comply with all current applicable building codes. These codes include but are not limited to:

1. Americans with Disabilities Act (ADA).
2. Building Code of New York State 2020 Edition.
3. NFPA 72 National Fire Alarm Code, 2016 Edition.
4. ASME A17.1 Safety Code for Elevators and Escalators, 2016 Edition.

5. NFPA 70 National Electric Code, 2017 Edition.

1.6 DEFINITIONS

A. Hydraulic Elevators: Elevators in which cars are hoisted either directly or indirectly by action of one or more hydraulic plungers and cylinders (jacks); with other components of the Work, including fluid storage tank, pump, piping, valves, car enclosures, hoistway entrances, operation systems, signal equipment, guide rails, electrical wiring, buffers, and devices for operations, safety, security, required performance at rated speed and capacity, and for complete elevator installation.

B. Defective Elevator Work: Operation or control system failures; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; the need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

C. Authority Having Jurisdiction (AHJ): For this project, the AHJ is the New York State Education Department.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Engage the elevator manufacturer or an experienced Installer approved by the elevator manufacturer who has completed elevator installations similar in material, design, and extent to that indicated for this Project and who has a documented record of successful in-service performance.

B. Regulatory Requirements: In addition to local governing regulations, comply with the applicable provisions of the codes and standards listed in Part 1.3.

C. Accessibility Requirements: In addition to local governing regulations, comply with Section 4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG)."

1.8 ENVIRONMENTAL HEALTH PROVISIONS FOR HYDRAULIC ELEVATOR CONTRACTS

A. At the commencement of the Contract, and continuously thereafter, the Contractor shall provide the Owner with a Safety Data Sheet (SDS) for each product to be used in conjunction with the elevators. The Contractor shall indicate which products are most likely to be used on site and describe how and where the products will be stored.

B. Throughout the Contract, all materials stored on site by the Elevator Contractor must be stored in compliance with all Federal, State, and local laws, regulations and codes as well as Owner policies and requirements.

C. Throughout the Contract, the Contractor shall utilize non-RCRA (Federal Resource Conservation and Recovery Act) materials where possible.

D. At the commencement of the Contract and continuously thereafter, the Contractor shall post an Emergency Procedure in each elevator machine room, with instructions to Contractor employees on the process for monitoring and reporting oil release. The Contractor shall submit the language of this procedure to the Owner for approval. As a minimum, the procedure shall require the Contractor to immediately report any release of oil from hydraulic cylinders, tanks, to ground, to water or to drain or any unexplained release to Owner.

E. Throughout the Contract, the Contractor shall make monthly checks of oil levels in elevator machine reservoirs and record the results of those checks in a permanent on site logbook.

F. Throughout the Contract, the Contractor shall maintain clear legible logs in all the elevator mechanical rooms indicating any oil replacement for each system. The log shall note the date, the quantity of oil added to the system, and the reason for such replacement, and the legible printed name of the person making the log entry. Any unexplained loss, or any suspected loss of oil shall be reported to the Owner immediately.

G. Throughout the Contract, no more than one gallon of oil shall be kept in an elevator mechanical room at any time. It shall be stored in compliance with applicable regulations and codes, in appropriate secondary containment. If larger quantities of waste or new oil are required in a particular room for a specific maintenance operation, the Contractor shall provide appropriate (110%) secondary containment and shall notify the Owner one week in advance of the proposed operation. The notification shall include the quantity of oil, proposed protection methods and proposed start date and duration of the operation.

H. Throughout the construction portion of the Contract and prior to final acceptance of the elevator system by the Owner, all waste oil, oily rags, and oily waste generated under performance of this Contract shall be considered as property of the Contractor and shall be appropriately stored for disposal by the Contractor. Upon final acceptance of the elevator system by the Owner and during any maintenance period that is part of the construction contract, all non-hazardous waste oils, oily rags requiring disposal, and oil contaminated absorbent material generated in performance of this contract shall be provided to the Owner for disposal.

I. Throughout the maintenance period, the Contractor shall notify the Owner of any waste material generated under the contract that has the potential to contain an “RCRA hazardous” component. Federal and/or State laws may prevent the Contractor from transporting hazardous waste on public rights of way.

1.9 WARRANTY

A. General Warranty: The elevator warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrently with, other warranties made by the Contractor under the requirements of the Contract Documents.

B. Standard Elevator Warranty: Submit a written warranty signed by manufacturer agreeing to repair, restore, or replace defective elevator work within the specified warranty period.

1. Warranty Period: 12 months from date of completion.

1.10 RELATED WORK TO BE PROVIDED BY OTHER SUBCONTRACTORS AS DESIGNATED BY THE CONSTRUCTION MANAGER: (DO NOT INCLUDE IN THE ELEVATOR BID)

A. Other Subcontractor will provide on-site storage area for elevator equipment. The area shall be dry and enclosed within the building. Space will provide rollable access to the elevator hoistway at ground level, adjacent to the hoistway.

B. Other Subcontractor shall provide on-site refuse containers for disposal of elevator packing material.

C. Other Subcontractor shall provide cut-outs to accommodate elevator equipment and patching/painting of walls, floors or partitions in the hoistway and machine room.

D. Other Subcontractor shall provide finished flooring material in elevator car.

E. Other Subcontractor shall provide painting of hoistway entrance, frames and areas surrounding frames, where required.

F. Other Subcontractor shall provide guarding and protection of the public from the hoistway during construction. Elevator Contractor shall provide barricades for the protection of workers as specified in this Section.

G. Other Subcontractor shall provide a permanent light fixture in each elevator pit together with GFCI outlet and light switch.

H. Other Subcontractor shall provide an enclosed Machine Room maintained at a temperature between 32°F and 95°F.

I. Other Subcontractor shall provide fire extinguisher in the Machine Room.

J. Other Subcontractor shall provide illumination of the Machine Room providing 19 footcandles minimum at the floor level.

K. Other Subcontractor shall provide a self-closing and self-locking door for Machine Room.

L. Other Subcontractor shall provide a fire alarm system interface with suitable relays for Phase 1 Recall and contact for firefighter’s hat activation. (Connection to Elevator Controller by Elevator Contractor).

M. Other Subcontractor shall provide 208Y/120V, 3-phase circuits for machine power and a separate 120V, 1-phase circuit for car lights.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering hydraulic elevators that may be incorporated in the Work include, but are not limited to, the following

1. Approved installation companies:

a. KONE Inc.
b. Otis Elevator Company.
c. Schindler Elevator Corporation.
d. TK Elevator.

2.2 GENERAL MATERIALS AND COMPONENTS

A. Provide DCSD standard equipment. Where components are not otherwise indicated, provide only non-proprietary, ASME A17.1 and ADA compliant components as required for a complete system.

2.3 ELEVATOR CAR

A. Existing elevator cab and interior finishes shall remain.

B. Provide and install new manufacturer's standard "Luxury" or "Premium" ADA compliant, vandal resistant applied-style Car Operating Panel (C.O.P.) with:

1. Satin stainless steel finish.
2. Hands free emergency telephone installed in the C.O.P.
3. Emergency light.
4. Keyed off/on switches for inspection, phase two fire service, run/stop, light, fan, hoistway access, and independent service.
    a. Fire Service: # FEO-K1.
    b. Independent, Lights and Fan: Vendor standard keying.
    c. Inspection, Hoistway Access, and Run: Vendor standard keying.
5. Red illuminated Fire emblem, and hands free phone call received.
6. Local Alarm button, call cancel, alarm, door open, and door close.
7. Provide illuminated buttons with Braille tags and audible signal registered display for each floor.
8. C.O.P. shall be provided with permanently engraved fire service instructions.
9. C.O.P. shall contain a digital position indicator with voice annunciation and passing chime.

C. Provide Car Top Inspection station with a guarded A19 Type LED lamp and switch and GFCI outlet.

D. Provide a complete car top handrail system.

E. Provide closed loop door operator, clutch, and car gate switch.

F. Provide all new hoistway door interlocks.

G. Provide all new door rollers and gibs on all hoistway and car doors.

H. Elevator numbers shall be permanently engraved within the C.O.P.

2.4 ENTRANCE FIXTURES

A. Provide and install manufacturer's standard "Luxury" or "Premium" ASME A17.1, AHJ approved, ADA compliant, vandal resistant hall call fixtures at 42″ center line above the finished floor. Primary recall landing shall have permanently engraved fire service instructions within the call station fixture.

B. All fixtures shall be surface-mount, ADA extender type, satin stainless steel finish.

C. Fire Service key switch on Primary recall landing only. Verify primary and secondary recall locations with the AHJ. Fixtures shall have illuminated buttons, Braille tags, and audible signal capability.

D. Provide fire pictographs on each landing, engraved on hall call fixtures.

E. Metal plate floor tags with Braille and raised lettering permanently attached to both sides of the doorframe jambs. Tags shall be riveted to the doorframe at 60″ above the finished floor. Tags shall be satin stainless steel.

F. Provide hoistway access key switches within hall call fixtures on terminal landing fixtures only.

G. Each entrance shall have a vandal resistant digital position indicator/directional lantern fixture located in the elevator lobby on every floor; the fixture shall be located directly adjacent to entrance. Fixture shall have one (1) stroke up and two (2) strokes down gong.

H. Provide emergency phone line monitoring buzzer, light and alarm silence keyswitch at primary recall landing only. These functions may be integrated into the hall station or provided as a separate fixture.

2.5 ENTRANCES

A. Existing hoistway doors and entrance frames shall remain.

B. Provide an infrared door edge detector.

C. Provide Tri-lock door key plug #6950 at each entrance.

D. Provide sight guards and door restrictors.

2.6 MECHANICAL

A. Remove and discard existing Dover DMC-1 controller. Provide and install new elevator controller in the Machine Room.

B. Hydraulic Machines and Elevator Equipment:

1. Existing tank and pump unit shall remain.
2. Provide Siemens electronic soft starter with LCD screen for programming and display.

C. Power Supply:

1. Locally available voltages are as scheduled on the Drawings.
2. Confirm available motor circuit ampacity as shown on the Electrical Plans and schedules.

D. Car Frame and Platform: Existing to remain.

E. Provide microprocessor controlled unit for Simplex operation:

1. Features:

a. Capacity shall be as specified in ASME A17.1.
b. Provide door nudging and pre-opening.
c. Terminate all required fire alarm connections as directed to provide Phase 1 Recall and Phase 2 Emergency Operation.
d. Provide manufacturer's standard factory installed remote monitoring communication interface for future Owner-supplied ethernet connection.
e. Provide hydraulic controller enclosure, wall mounted.
f. Provide connection for phone line (provided by others) for emergency phone. Verify type of ring-down service.
g. Make provisions to connect light/fan circuits to separate power disconnect left in the vicinity of the controller by a separate subcontractor designated by the Construction Manager.
h. Provide viscosity control programming.
i. Provide low oil sensor.
j. Provide high oil temperature cutout, 70°C setting.
k. Provide factory installed support for Owner-provided card reader security.

F. Provide approved capacity plates.

G. Provide interlocks and terminal landing devices. Pin all switches to rails where rail connections are made.

H. Provide fascias, dust covers, and toe guards.

I. Provide traveling cable; number and type of conductors to suit elevator controller requirements. Provide additional communications-only traveling cable with CAT5e twisted shielded pairs for use with security camera (provided by Owner). Cable shall also contain standard twisted shielded pairs for emergency phone and in-car card reader. Draka Model 180020-00 with manufacturer-provided RJ-45 terminal blocks.

J. Provide pit stop switches. Stop switch shall be pushed to stop, pulled to run, mushroom head style. A toggle switch is not acceptable.

K. All hoistway wiring shall be wholly enclosed in cableways.

2.7 MICROPROCESSOR LOGIC CONTROLLER

A. Function:

1. The controller shall start and stop the car smoothly and shall cause the cab to make accurate landings under all load conditions.

2. Components and operating devices shall govern starting, stopping, direction of travel, acceleration, retardation and speed.

B. Type: Microprocessor based self-diagnostic programmable controller with an Erasable Programmable Read Only Memory with provisions for enabling random access memory for such items as timer adjustments and motion control tuning.

1. The printed circuit boards (modules) shall be of the type that plug into prewired mounting racks. No field wiring or alteration shall be necessary in order to replace defective modules.
2. Any field wiring changes required during construction shall be required to be made only to the mounting rack connection points and not to the individual module circuitry or components. If it becomes necessary to alter individual modules, they shall be returned to the factory where such design changes may be made so that correct replacements units are available.
3. Wiring connections for operating circuits and for external control circuits shall be brought to terminal blocks mounted in an accessible location within the controller cabinet. Terminal blocks using pierce-through serrated washers shall not be accepted.
4. Safety and Motion Circuits: Electro-Mechanical pilot type relays. Safety circuits shall be monitored by the microprocessor for redundant protection. All outputs shall be individually fused.
5. Identify each device and fuse (ampere rating) on panels by name, letter, or standard symbol, in an approved indelible and legible manner. Coordinate identification markings with wiring diagrams. All logic symbols and circuitry designations shall be in accordance with ANSI Standards.

C. Hand-Held Diagnostic Tester: Shall plug into the control processing unit or shall be capable of being cable connected. Tester shall enable operators to monitor logic, timer, and counter values for more productive operation. Tester shall be furnished to Owner at completion of the Project. Integral (LED) diagnostic devices shall be acceptable in lieu of hand-held tester.

D. Fault Protection System:

1. Protect against the following:

a. Complete power circuits protect from failure under short circuits.
b. Surge protection.
c. Overload.
d. Low voltage, phase loss, unbalanced voltage.

E. Components and Operating Devices:

1. Reverse phase relay.
2. Additional components and devices as required to suit type of operation specified.

F. Operation:

1. Provide selective-collective automatic operation as defined in ASME A17.1. Provide optional home landing to floor selected by Owner.

2.8 HYDRAULIC JACK-CYLINDER ASSEMBLY

A. Existing to remain.

2.9 HYDRAULIC OIL

A. Type and grade as recommended by equipment manufacturers. The viscosity of the hydraulic fluid shall be thermostatically controlled to maintain the fluid temperature in the reservoir, pump and valves at a consistent operating viscosity.

2.10 OIL HYDRAULIC MUFFLER

A. Existing to remain.

2.11 PIPE AND PIPE FITTINGS

A. Existing to remain.

2.12 CONTROL VALVE

A. Remove and discard existing Dover valve, Provide Maxton UC-4 valve.

2.13 GUIDE RAILS

A. Existing to remain.

2.14 PAINT

A. Rust inhibitive primer and paint shall be used where painted surfaces are specified.

PART 3 - EXECUTION

3.1 DELIVERY OF TOOLS, MATERIALS AND EQUIPMENT

A. The Contractor shall assume responsibility and all costs associated with the delivery and removal of all materials and equipment. The Contractor shall furnish all trucking, rigging, and transportation for all items required to complete the project. In addition, the Contractor shall accept responsibility to protect the grounds, building, and building contents during associated deliveries and removals.

3.2 BARRICADES

A. Solid barricades shall completely enclose entrances to the shaft from the public and shall have a keyed locked entrance on each floor. Each barricade shall completely contain all portions of the project for each individual landing to a height of not less than 8′-0″ or to the ceiling. At no time shall the barricades be removed prior to the installation of fully functional safety interlocks, and installation of walls. At no time shall any entrance be left open to any elevator shaft. Contractor shall comply with any and all Occupational Safety and Health Standards for general industry (26 CFR 1911) and for the Construction Industry (29 CFR 1926.) Special attention shall be addressed to Sections 1926.502 Personal Fall Arrest Systems and especially 1926.502(d)(ii) regarding work in Elevator Shafts by all persons working inside the guarded areas. The Contractor shall be required to show documentation that each person who has access to the elevator entrances has been trained in the proper use of personal fall protection. The Owner reserves the right to require additional safety precautions at any time. A copy of the “Elevator Industry Field Employee’s Safety Handbook” shall be required on the site at all times and an additional copy shall be provided to the Owner along with a job specific safety program prior to the beginning of any work. Perform work at all times in accordance with the minimum requirements of the “Elevator Industry Field Employee’s Safety Handbook,” published by Elevator World.

3.3 DUST PROTECTION

A. Barricades shall be so constructed as to protect adjacent portions of the building from dust and debris. Barricades shall be arranged to avoid damage to existing building finishes.

3.4 INSTALLATION

A. General: Install hydraulic elevator power unit, oil storage tank, piping and pumps in the machine room.

1. Mount power unit bedplate and steel frame assembly, on floor of machine room. Bolt in place using appropriate vibration isolator. Install a data plate on the tank framing indicating the characteristics of the hydraulic fluid used, actual no-load and full load working pressures, and relief valve pressure setting. Permanently mark oil level in tank with car at lowest landing.

B. Cylinders and Plungers:

1. Install cylinders and plungers plumb, centered accurately and shimmed to proper elevation.

C. Buffers:

1. Install the spring buffers on the pit channels. Block buffers up as required to protect cylinder heads and packing glands in the event car should pass bottom limit switch setting.
2. Install striking plates on car frame to engage buffers.

3.5 ELEVATOR EQUIPMENT

A. Install equipment in strict accordance with manufacturer’s printed installation instructions.

B. All discarded materials are the sole responsibility of the Contractor to completely remove from the site at their expense. Contractor shall be responsible for documenting compliance with project construction waste diversion plans.

3.6 TESTING

A. The Contractor shall provide for all testing and inspection services. The Contractor shall provide for a reasonable amount of time to integrate the elevator operations with the work of other trades. The Contractor shall provide a unit cost within the Base Bid for additional labor where requested by the Owner. The Contractor shall provide a complete functioning elevator, approved by the AHJ, and is required to make any corrections directed by the AHJ to obtain final approval.

3.7 EXAMINATION

A. Examine elevator areas, with installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of elevator work. Examine hoistways, hoistway openings, pits, and machine rooms, as constructed; verify critical dimensions; and examine supporting structure and other conditions under which elevator work is to be installed. Do not proceed with installation until unsatisfactory conditions have been corrected.

1. For the record, prepare a written report, endorsed by the installer, listing dimensional discrepancies and conditions detrimental to the performance of elevator work.

3.8 ADDITIONAL REQUIREMENTS

A. Comply with manufacturer's instructions and recommendations.

B. Welded Construction: Where welded construction is used, comply with AWS standards for workmanship and for qualifications of welding operators.

C. Coordination: Coordinate elevator work with work of other trades for proper time and sequence to avoid construction delays. Use established benchmarks, lines, and levels to ensure dimensional coordination of the Work.

D. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts designed to effectively prevent transmission of vibrations to structure and thereby eliminate sources of structure-borne noise from elevator system.

E. Lubricate operating parts of systems, including ropes, if any, as recommended by manufacturers.

F. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimensions at each landing.

G. Leveling Tolerance: ¼″ (6 mm), up or down, regardless of load and direction of travel.

H. Set sills flush with finished floor surface at landings. Fill space under sills solidly with non-shrink, non-metallic grout.

I. Provide minimum run-by and areas of refuge as specified in the latest issue of ASME A17.1.

3.9 FIELD QUALITY CONTROL

A. Engineer's pre-inspection prior to formal acceptance testing: Prepare for and conduct testing for Engineer's pre-inspection prior to scheduling formal acceptance testing with the AHJ. Conform with Specification Section 14 28 00 - Elevator System Startup & Witnessed Testing. Demonstrate the function of all buildings to elevator interfaces, including fire alarm shutdown, recall, lighting, ventilation, operation on emergency generator, etc. Do not bring in an Elevator Inspector until the Contractor has demonstrated the functionality of the above tests in the presence of the Engineer.

B. Acceptance Testing: Upon nominal completion of elevator installation, and before permitting use (either temporary or permanent) of elevators, perform acceptance tests as required and recommended by ASME A17.1 and by the AHJ.

C. Advise the Owner, Architect/Engineer, and Authorities Having Jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.10 DEMONSTRATION

A. Instruct Owner's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at times of failure in operation and other building emergencies. Train Owner's personnel in procedures to follow in identifying sources of operational failures or malfunctions. Confer with Owner on requirements for a complete elevator maintenance program.

B. Make a final check of each elevator operation with Owner's personnel present and just prior to date of Substantial Completion. Determine that operating systems and devices are functioning properly.

3.11 PROTECTION

A. Temporary Use: Do not use an elevator for construction purposes unless cars are provided with temporary enclosures, either within finished cars or in place of finished cars, to protect finishes from damage.

B. By Alternate:

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

C. Provide final protection and maintain conditions, in a manner acceptable to elevator manufacturers and installers, that ensure elevators are without damage or deterioration at the time of Substantial Completion.

3.12 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance service by skilled, competent employees of the elevator installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrications, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Use parts and supplies as used in the manufacture and installation of original equipment.

B. Perform maintenance, including emergency callback service, during normal working hours.

1. Include 24-hour-per-day, 7-day-per-week emergency callback service.

a. Response Time: 2 hours or less.

C. Continuing Maintenance Service: Provide a continuing maintenance proposal from Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms.

D. Provide full maintenance service by skilled, competent employees of the elevator Installer for elevators used for construction purposes. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at a rated speed and capacity. Use parts and supplies as used in the manufacture and installation of original equipment.

3.13 "AS-BUILT" DRAWINGS

A. The Contractor shall be required to prepare and submit a set of Division 14 "As-Built" Drawings as the portions of work are completed and prior to application for final payment.

B. The "As-Built" Drawings shall include a full set of the 'as bid' or 'conformed' Contract Drawings for Division 14.

C. The submitted Drawings shall be in the form of full size as-bid first plus additional drawings and attachments following. The Drawings shall be clean, original paper copies of the Contract Drawings, marked up in red pencil or pen with the Contractor's markups. For Floor Plans drawn at less than ¼" scale, the field drawings shall be expanded to ¼" scale to provide room for mark ups.

D. The Contractor shall maintain a dedicated set of Construction Drawings at a protected location at the job site for the continuous documentation for these as-builts. The Contractor shall record the actual installed locations of equipment, wiring, conduit/pathway, etc. Record any and all variations from the original Construction Drawings in neat, legible, hand drawn lines and text. Attach copies of Contractor's field sketches and note where they pertain.

E. Confirm that all information provided to the Contractor in the Form of Request for Information (RFI) responses, accepted Requests for Proposal (RFPs), Change Orders and Supplemental Instructions (SIs) are properly conveyed on the Drawings. Show the actual changes made, do not just paste a copy of the RFI, RFP, ASI, or CO unless that document includes a full scale drawing which accurately represents the work actually installed.

F. Confirm that the room names and numbers shown on the As-Built's are the actual room numbers and names posted on the rooms at the time of turn over.

G. Confirm that equipment schedules accurately depict any changes made during construction.

H. For work which becomes concealed as part of the project, keep an accurate record and show on "As-Built" Drawings the actual installed location of any concealed work such as conduit, piping, etc. Provide location on Record Drawings for outside services by indicating actual dimensions from fixed reference points which will be available after completion of construction. "Tie" two (2) dimensions from different reference points to confirm locations of concealed work.

I. For projects extending more than three months, provide the original "As-Built" to the Engineer as the work is completed on sections of the project and obtain a receipt from the Engineer. The Contractor shall be responsible for the safe keeping and maintenance of the "As-Built" Drawings throughout construction, and for maintenance of one (1) photocopy at the Contractor's office for a period of not less than three (3) years following final acceptance.

J. Provide the original copies of the "As-Built" Drawings to the Architect or Engineer in accordance with the provisions of the General Conditions and Division 1. Unless reproducible "As-Built" Drawings are required under the General Condition and Division 1, provide the original paper copy of "As-Built" Drawings to the Engineer.

3.14 OPERATION AND MAINTENANCE INFORMATION

A. Submit Operation and Maintenance Manuals per Division 1. Submit reviewed manual content formatted and organized as required by this Section.

1. The Architect/Engineer will comment on whether content of Operation and Maintenance submittals is acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect/Engineer will comment on whether the general scope and content of the manual are acceptable.

C. Final Manual Submittal: Submit each manual in the final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. The Architect will return a copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

D. Comply with Division 1 for schedule for submitting Operation and Maintenance documentation.

E. Format of Operation and Maintenance Manuals: Submit manuals in the form of a single composite electronic PDF file.

1. Electronic Files: Use electronic files prepared by manufacturers where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size. "Recognize Text" shall be run on all scanned documents to provide a text searchable PDF.

F. Organization and Requirements for Operation and Maintenance Manuals: Unless otherwise indicated, organize each manual into the format as described below, and as indicated in Division 1.

1. Title Page: Indicate Building Name, Project Title and Owner's Project Number.
2. Table of Contents: Hyperlinked bookmarked information with links to each CSI Master Format specification section contained in manual.
3. Contact List: Indicating name and contact information for the following:
    a. Construction Manager or General Contractor.
    b. Subcontractor.
    c. Architect.
    d. Architect's Subconsultants.
4. Project Warranties: Include the overall project warranty and hyperlinks to any special warranties included in equipment's specification sections.
5. Operations and Maintenance Information: Operations and Maintenance information for every CSI specification section included in project. Each section shall contain the final submittal that has been updated to include any architectural remarks, any special Contractor or manufacturer warranty associated with the equipment or system, the installation, Operations and Maintenance manuals for each piece of equipment, including any accessory components, all test reports for systems and equipment and parts list for each piece of equipment.
6. Include a typed guarantee from the Contractor with a one year guarantee stated as commencing on the date of final acceptance.
7. The Contractor shall include a completed copy of the O&M Manual checklist which follows this section as the last page of the O&M Manual.

O&M Manual Checklist Date_____

(Include a completed copy of this Checklist in O&M Manual when submitted)

Project_____ Trade_____

Project Name_____

Submitted as an electronic file per Section 01 78 23 YES / NO

Composite electronic PDF file YES / NO

Minimum readable text size YES / NO

Title page "Recognize Text" turned on for all scanned documents YES / NO

……

O&M Manual:

Cover Sheet listing:

Building Name

O&M Manual Table of Contents: Hyperlinked book-marked information with links to each CSI Master Format Specification Section in manual
YES / NO

O&M Manual Contact List:

Contractor
Contractor Name _____
Contractor's Address _ _____
Contact person _____
Tel. & Fax #'s _____

Each Major Subcontractor
Contractor Name _____
Contractor's Address _____
Contact person _____
Tel. & Fax #'s _____

Project Manager
Name

Engineer
Name
Company Name _ _____
Contact person _____

Architect
Name
Company Name _____
Contact person _____

……

O&M Manual - Remaining Pages: Checklist Page 2

O&M Manual Project Guarantee & Warranties:

Typed guarantee from Contractor with 1 year guarantee stated as commencing on the date of final acceptance by the University. Date must be identified _____

Hyperlinks to any special warranties included in Equipment Specifications YES / NO

1. Organized by CSI Specification Section number. YES / NO
2. Each CSI Specification Section included. YES / NO
3. Includes final submittal, updated to contain A/E remarks. YES / NO
4. Includes any special Contractor or manufacturer warranty. YES / NO
5. Includes the Installation, Operation and Maintenance (IOM) manuals for each piece of equipment, up to date for the version of equipment supplied. YES / NO
6. Includes IOM data for accessory data. YES / NO
7. Includes test reports for each piece of equipment. YES / NO

Scan of spare parts list. _____
Scan of all test reports (i.e., fire alarm). _____
Scan of all inspections (i.e., plumbing, electrical). _____
Scan of all certification data. _____
Scan of facility lubrication chart. _____
Scan of facility valve chart. _____
Scan copy of complete temperature control and operating instructions. _____
Completed copy of checklist last page of O&M Manual. _____

END OF SECTION 14 25 00

ELEVATOR SYSTEM STARTUP & WITNESSED TESTING 14 28 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE

A. This Section includes the following:

1. Engineer's pre-inspection elevator testing of building interfaces.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 WITNESSED TESTING

A. At the completion of the elevator installation, prior to calling in for an elevator inspection, the Construction Manager shall review and complete the attached pre-inspection checklist. Once the Construction Manager is satisfied that all work is successfully completed, the Construction Manager shall notify the Engineer and Owner that the elevator is complete and shall submit the attached completion certification to the Engineer, suitably signed. The Engineer and Owner shall arrange to be present on site to witness the elevator operation. The following operations shall be verified:

1. Normal operation, including independent service.
2. Card security functionality (if provided).
3. Operation on emergency power, including pre-transfer landing and emergency power indicator light functionality (if provided).
4. Recall and fire service operation, including primary and secondary recall, fire fighters hat functionality.
5. Shunt trip operation (if provided).
6. Emergency phone functionality.
7. Remote elevator control panel functionality (if provided).
8. Emergency two-way visual communication system (if provided).

END OF SECTION 14 28 00

DERUYTER CENTRAL SCHOOL

Owner

DeRuyter Central School District
711 Railroad Street
DeRuyter, New York 13052
Phone (315) 852-3400

Engineer

Peterson Guadagnolo Consulting Engineers PC
476 East Brighton Ave
Syracuse, NY 13210
Phone (315) 476-8311

Pre-Inspection Checklist for New Elevator Installations & Modernizations

Notice: This checklist reflects the most common issues encountered when performing an Engineer's inspection. The Engineer's inspection does not preclude the Contractor from obtaining an AHJ approved elevator inspection. Violations not indicated below may appear during AHJ inspections. It is suggested that elevator industry personnel have access to a current set of applicable code books. The most common industry code books are: The ASME A17.1 Elevator Code 2016 Edition; The 2020 Building Code of New York State; NFPA 13 Sprinkler Code; NFPA 72 Fire Alarm Code; NFPA 70 National Electric Code.

Instructions:
Check each box when the item is completed. Note any variances received from New York State. Submit the completed form to the Engineer prior to scheduling the Engineer's inspection.

-In the Machine Room and/or Control Room

- ❑ All non-elevator-related piping and equipment are prohibited from entering or passing through the machine room per ASME A17.1 Section 2.8.1.
- ❑ Electrical disconnects must be lockable in the open position and properly located within sight of the elevator devices as outlined in NFPA 70 Section 620.51. All disconnects must be properly fused or utilize a non-self-resetting circuit breaker.
- ❑ A dedicated circuit with lockable fused disconnect is required to be located in the machine room serving the car lighting per NFPA 70 Section 620.22.
- ❑ A dedicated circuit shall service machine room lighting and receptacles. Receptacles in the machine room shall have GFCI protection by a GFCI-type receptacle NFPA 70 Section 620.85.
- ❑ Warning signs shall be posted when there is power from more than one source per NFPA 70 Section 620.52
- ❑ Electrical clearances are to be provided and maintained in front of the controller and disconnect at all times. It is interpreted that machine room doors that swing into the electrical clearance area endanger worker safety and are prohibited.
- ❑ Machine rooms are to be properly lighted, so the electrical control devices and machinery are well illuminated. The light switch is to be located in the machine room and placed near the machine room door jamb per ASME A17.1 Section 2.7.9.1. The required lighting shall not be connected to the load side of a GFCI per NFPA 70 Section 620.23.
- ❑ All electrical equipment, controllers, and machines are to be properly installed and grounded per NFPA 70 Section 620 Part IX. All electrical conduits are to be properly secured and routed in a workmanlike manner.
- ❑ An "ABC" type fire extinguisher is required to be located in the room per ASME A17.1 Section 8.6.1.6.5.
- ❑ Holes around piping and structure penetrations in the machine room are to be properly filled and firestopped to maintain a fire rated enclosure.

- ❑ The machine room door is to be self-closing and self-locking per ASME A17.1 Section 2.7.3.4.
- ❑ The clear headroom in the machine room shall be not less than 7 feet per ASME A17.1 Section 2.7.4.1.
- ❑ Machine rooms are to be vented and/or heated by mechanical or natural means to ensure proper operating temperatures of the equipment at all times per ASME A17. 1 Section 2.7.9.2. If the elevator machine room is provided with standby power, the machine room HVAC shall be provided with standby power as well.
- ❑ Where sprinklers are provided in the elevator machine room, they shall be served by a dedicated branch line with non-retardable flow switch and control valve with tamper switch. Alternatively, a preaction sprinkler system may be installed. In either case, sprinkler activation in the machine room shall activate shunt trip operation.
- ❑ The circuit supplying the shunt trip device coil shall be served by emergency power, when available, and shall be monitored for power loss.

-In the Pit Area

- ❑ A pit ladder is required with a handrail at least 42″ above the landing. The ladder is to be non-combustible and located near the jamb side of the hoistway door, the rungs are to have a clearance of not less than 4½″, spaced 12″ apart and not less than 12″ wide. See ASME A17.1 Section 2.2.4.
- ❑ A pit stop switch is to be located adjacent to the pit ladder and 18″ above the landing in order to be accessible before stepping onto the pit ladder. A second pit stop switch is required when the pit exceeds 67″ in depth. See ASME A17.1 Section 2.2.6.
- ❑ A light for the pit is to be located so as to provide adequate lighting for the area. The switch is to be near the stop switch. The light is to be guarded. See ASME A17.1 Section 2.2.5. The required lighting shall not be connected to the load side of a GFCI per NFPA 70 Section 620.24.
- ❑ A dedicated circuit shall service pit lighting and receptacles per NFPA 70 Section 620.23. A GFCI type receptacle is required in pits per NFPA 70 Section 620.85. When a sprinkler is present in the pit area, a weatherproof while-in-use cover is required. A single receptacle supplying a permanently installed sump pump shall not require GFCI protection per NFPA 70 Section 620.85.
- ❑ Sprinklers are required in the pits of hydraulic elevators and are to be served by a dedicated branch line with flow switch and control valve with tamper switch. See NFPA 13 Sections 8.15.5.1 and 8.15.5.2. Activation of sprinkler heads located not more than 24" off the pit floor shall not activate shunt trip operation.

-In the Hoistway

- ❑ All non-elevator-related piping and equipment are prohibited from entering or passing through the hoistway per ASME A17.1 Section 2.8.1.
- ❑ All offsets or ledges within the hoistway greater than 4″ are to be tapered to not less than 75 degrees per ASME A17.1 Section 2.1.6.
- ❑ In general, sprinklers are not required in elevator hoistways and shall be prohibited. Where sprinklers are required, they are to be served by a dedicated branch line with non-retardable flow switch and control valve with tamper switch. Sprinkler activation in the elevator shaft shall activate shunt trip operation.
- ❑ Hoistway ventilation is not required by the Building Code of New York State and shall not be provided.

-General, Operations, and Building Interface

- ❑ A hands-free emergency phone shall be provided in the elevator car.
- ❑ Fire alarm initiating devices must be properly located in each elevator lobby and in the machine room. Activation of these devices shall initiate primary or alternate recall, as required.
- ❑ Smoke detectors and heat detectors are required in the hoistway when a sprinkler head is located in the hoistway. See ASME A17.1 Section 2.27.3.2 & NFPA 72. Fire alarm initiating devices in the machine room or hoistway, if provided, shall initiate primary or alternate recall shall cause the visual signal in the car to illuminate intermittently per ASME A17.1 Section 2.27.3.2.
- ❑ Smoke detectors shall not actively shunt trip. Shunt trip shall only be activated by flow switch on branch lines serving machine room and hoistway (if provided), or by heat detectors located in these same areas.
- ❑ In general, glass is prohibited in elevator cars and hoistways.
- ❑ If card access security is provided, activation of recall and/or fire service shall bypass all lockouts and restrictions.
- ❑ If elevator machine is provided with standby power, the elevator shall be interlocked with the transfer switch feeding the elevator such that when the elevator is operating on emergency power, an indicator is lit at the primary recall floor. See ASME A17.1 Section 2.27.2.3. Additionally, the elevator shall move to the nearest floor and open its doors prior to transfer switch operation.
- ❑ Loss of power to a group of elevators provided with emergency power shall cause sequential recall of elevators. Operation of elevators on emergency power shall be determined by position of generator selector switch.
- ❑ If provided, a remote elevator control panel shall be provided with position indicator, fire service switch, and generator selector switch, if required. Fire service switch at remote elevator control panel shall be On-Off only.
- ❑ Illumination at the landing sill shall be not less than 10 footcandles per ASME A17.1 Section 2.11.10.2.

❑ All signage required by NFPA 70 and ASME A17.1 must be properly installed including the following examples: code data plates, fire service instructions, emergency identification numbering, hoistway door floor numbers, rope data tags, in-car capacity tags, crosshead data tags, governor rope data tags, full-load working pressures, and governor tripping speeds.

I certify that the above items have been verified and found to be in proper working order for the following elevator(s).

Elevator(s): _____
Certified by: Print Name: _____ Signature:_____
Company: _____
Date: _____ Phone: _____

Remarks:

_____

_____

_____

_____

_____

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Firestopping materials.

B. Firestopping of all penetrations, openings, and interruptions to fire rated assemblies, whether indicated on drawings or not, including but not limited to piping, tubing and similar utilities passing through or penetrating fire rated walls and floor assemblies.

1.2 RELATED SECTIONS

A. Refer to "Code Compliance Drawings" for location of fire rated assemblies. At a minimum all corridor walls and all floors between stories have a 1hour rating.

1.3 REFERENCES

A. ASTM International:

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

2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

B. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.

C. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.

2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

3. UL 1479 - Fire Tests of Through-Penetration Firestops.

4. UL - Fire Resistance Directory.

D. Plumbing and Fuel Gas Codes of New York State.

1.4 FIRE-STOP SYSTEM PERFORMANCE REQUIREMENTS

A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration fire-stop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire walls, fire partitions, fire barriers and smoke barriers.

2. Fire-resistance-rated horizontal assemblies including floors and ceiling membranes of roof/ceiling assemblies.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each through-penetration fire-stop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include fire-stop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated. Submit UL Standard detail for each penetration type proposed.

1.6 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs which provide the specified fire ratings when tested in accordance with methods indicated.

1. Listing in the current-year classification or certification books of UL will be considered as constituting an acceptable test report.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Hilti.

B. Nelson Fire Stop Products.

C. Specified Technology.

D. 3M Fire Protection Products.

E. Approved equals meeting UL requirements.

2.2 MATERIALS

A. Sealant Firestopping:

1. Intumescent firestop sealant designed to expand when exposed to fire.

2. Paintable

3. Fire Resistance: Up to 4 hours

4. Curing Time: 14-21 days

5. Elongation: 5%

6. Density: 1.5 g/cm3

7. Product: FS-ONE Intumescent Firestop Sealant manufactured by Hilti USA.

8. Uses: Insulated and uninsulated metal pipes, with or without sleeve and plastic pipes.

B. Silicone Sealant Firestopping:

1. Silicone based firestop sealant that provides maximum movement in fire-rated joint applications and pipe penetrations.
2. Not paintable
3. Fire Resistance: Up to 4 hours
4. Elongation: 25%
5. Product: CP 601S Elastomeric Firestop Sealant manufactured by Hilti USA.
6. Uses: Joints in walls, floor to floor or fire compartments.

C. Safing Insulation:

1. Mineral-wool type insulation.
2. Thickness: 1" to 1-1/2"
3. Density: 4 to 8 pcf
4. Product: THERMAFIBER Safing Insulation

D. D.

1. Provide sleeves as required by section 1206.4 of the Mechanical Code.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration fire-stop systems to comply with fire-stop system manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration fire-stop systems.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration fire-stop systems. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration fire-stop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General

1. Install materials in manner described in UL Detail and in accordance with manufacturer's instructions, completely closing openings.

B. Installation

1. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping and other items, requiring firestopping.

2. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

3. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.

4. Fire Rated Surface:

    a. Seal opening at floor, wall, partition, and roof as follows:

        1 Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.

        2 Size sleeve allowing minimum of 1 inch void between sleeve and building element.

        3 Pack void with backing material.

        4 Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

    b. Where plumbing piping penetrates a fire rated surface, install firestopping product in accordance with manufacturer's instructions.

5. Non-Rated Surfaces:

    a. Seal opening through non-fire rated wall, floor, ceiling, and roof opening as follows:

        1 Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.

        2 Size sleeve allowing minimum of 1 inch void between sleeve and building element.

        3 Install type of firestopping material recommended by manufacturer.

    b. Install floor plates or ceiling plate where piping penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.

    c. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of piping and tighten in place, in accordance with manufacturer's instructions.

C. Identification:

1. Identify through-penetration fire-stop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the fire-stop systems so that labels will be visible to anyone seeking to remove penetrating items or fire-stop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:

    a. The words "Warning - Through-Penetration Fire-Stop System - Do Not Disturb. Notify Building Management of Any Damage."

    b. Date of installation.

    c. Through-penetration fire-stop system manufacturer's name.

3.4 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration fire-stop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration fire-stop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration fire-stop systems immediately and install new materials to produce systems complying with specified requirements.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe Markers.

1.2 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping.

1.3 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

1.4 SUBMITTALS

A. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Seton Identification Products.

B. Brady Corporation

C. Emed Company.

2.2 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.
2. Letter Height: 3/8 inch.
3. Nameplate Height: 3/4 inch.
4. Background Color: Black.

2.3 PIPE MARKERS AND ACCESSORIES

A. Snap-on Marker: One piece wrap around type constructed of precoiled acrylic plastic with clear polyester coating, integral flow arrows, legend printed in alternating directions, 3/4 inch adhesive strip on inside edge, and 360 degree visibility.

B. Strap-on Marker: Strip type constructed of precoiled acrylic plastic polyester coating, integral flow arrows, legend printed in alternating directions, factory applied grommets, and pair of stainless steel spring fasteners.

C. Stick-on Marker: Pressure sensitive adhesive backed type constructed of vinyl with clear polyester coating, and integral flow arrows for applications where flow arrow banding tape is not being used.

D. Pipe Marker Legend:

1. Outside Diameter of Pipe or Insulation 3/4 to 1-1/4 inch:
    a. Letter size: 1/2 inch.
    b. Length of color field: 8 inches.
2. Outside Diameter of Pipe or Insulation 1-1/2 to 2 inches:
    a. Letter size: 3/4 inch.
    b. Length of color field: 8 inches.
3. Outside Diameter of Pipe or Insulation 2-1/2 to 6 inches:
    a. Letter size: 1-1/4 inch.
    b. Length of color field: 12 inches.
4. Outside Diameter of Pipe or Insulation 8 inches and greater:
    a. Letter size: 2-1/2 inch.
    b. Length of color field: 18 inches.

E. Color: Conform to ANSI A13.1.

F. Banding Tapes: Pressure sensitive adhesive backed type constructed of vinyl with clear polyester coating.

1. Plain Tape: Unprinted type; color to match pipe marker background.
2. Flow Arrow Tape: Printed type with integral flow arrows; color to match pipe marker background.

PART 3 EXECUTION

3.1 PREPARATION

A. Complete testing, insulation, and finish painting work prior to completing the Work of this Section.

B. Clean pipe and equipment surfaces with cleaning solvents prior to installing piping identification or equipment tags.

C. Remove dust from insulation surfaces with clean clothes prior to installing piping or equipment identification.

3.2 INSTALLATION

A. Install the Work of this Section in accordance with the manufacturer's printed installation instructions, unless otherwise specified.

B. Stick-On Pipe Markers:

1. Install minimum of 2 markers at each specified location, 90 degrees apart on visible side of pipe.
2. Encircle ends of pipe markers around pipe or insulation with banding tape with one inch lap. Use plain banding tape on markers with integral flow arrows, and flow arrow banding tape on markers without integral flow arrows.

3.3 PIPING IDENTIFICATION

A. Piping Identification Types:

1. Piping or Insulation under 3/4 inch od: Pipe identification tags.

2. Piping or Insulation 1 inch and larger: Snap-on pipe markers or stick-on pipe markers.

B. Identify exposed piping, bare or insulated, as to content and direction of flow, with the following exceptions:

1. Piping in non-walk-in tunnels or underground conduits between manholes.

2. Piping in furred spaces or suspended ceilings, except at valve access panels where valves and piping shall be identified as specified for exposed piping systems.

3. Piping exposed in finished spaces such as offices, classrooms, wards, toilet rooms, shower rooms, and corridors.

C. Locate piping identification to be visible from exposed points of observation.

1. Locate piping identification at valve locations; at points where piping enters and leaves a partition, wall, floor or ceiling, and at intervals of 20 feet on straight runs.

2. Where 2 or more pipes run in parallel, place printed legend and other markers in same relative location.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.2 RELATED REQUIREMENTS

A. Section 22 0515 - Plumbing Firestopping.

B. Section 22 1005 - Plumbing Piping.

1.3 REFERENCE STANDARDS

A. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2007.

B. ASTM C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus; 2004.

C. ASTM C 195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007.

D. ASTM C 449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007.

E. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2004.

F. ASTM C 533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2009.

G. ASTM C 534/C 534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2008.

H. ASTM C 547 - Standard Specification for Mineral Fiber Pipe Insulation; 2007.

I. ASTM C 610 - Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation; 2009.

J. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.

K. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials; 2005.

L. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

M. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than five years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum five years of documented experience.

C. Regulatory Requirements:

1. Insulation installed inside buildings, including laminated jackets, mastics, sealants and adhesives shall have a Fire Spread/Smoke Developed Rating of 25/50 or less based on ASTM E 84, NFPA 255, and UL 723.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.7 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.1 PIPING INSULATION

A. Fibrous Glass (Mineral Fiber) Insulation: Composed principally of fibers manufactured from rock, slag, or glass, with or without binders, and asbestos free.

1. Manufacturers:

a. Johns Manville Corporation.

b. Knauf Fiber Glass.

c. Owens Corning Corporation.

2. Preformed Pipe Insulation: Minimum density 3 pcf; ASTM C 547.

a. Class 1 (Suitable for Temperatures Up to 450 degrees F): 'K' value of 0.26 at 75 degrees F.

3. Premolded Fitting Insulation: Minimum density 4.0 pcf, K of 0.26 at 75 degrees F; ASTM C 547, Class 1.

4. Insulation Inserts for PVC Fitting Jackets: Minimum density 1.5 pcf, K of 0.28 at 75 degrees F; ASTM C 553, Type III.

a. Suitable for temperatures up to 450 degrees F.

B. Cements:

1. Fibrous Glass Thermal Insulating Cement: Asbestos free; ASTM C 195.

2. Fibrous Glass Hydraulic Setting Thermal Insulating and Finishing Cement: ASTM C 449/C 449M.

2.2 INSULATION JACKETS AND FITTING COVERS

A. Premolded PVC Fitting Jackets:

1. Constructed of high impact, UV resistant PVC.

a. ASTM D 1784, Class 14253-C.

b. Working Temperature: 0-150 degrees F.

2.3 ADHESIVES, MASTICS, AND SEALERS

A. Lagging Adhesive (Canvas Jackets): Childer's CP-50A, Epolux's Cadalag 336, Foster's 30-36.

B. Vapor Seal Adhesive (Fibrous Glass Insulation): Childers' CP-82, Epolux's Cadoprene 400, Foster's 85-75 or 85-20.

C. Vapor Barrier Mastic/Joint Sealer (Fibrous Glass Insulation): Childers' CP-30, Epolux's Cadalar 670, Foster's 95-44 or 30-35.

D. Adhesive (Flexible Elastomeric Foam): Armstrong's 520, Childers' CP-80, Epolux's Cadoprene 488, Foster's 82-40.

E. Adhesive (Reinforcing Membrane): Childers' Chil-Spray WB CP-56.

F. Mastic (Reinforcing Membrane): Childers' AK-CRYL CP-9.

G. Sealant (Metal Pipe Jacket): One-part silicone sealant for high temperatures; Dow Corning's Silastic 736 RTV or General Electric's RTV 106.

2.4 MISCELLANEOUS MATERIALS

A. Insulation Fasteners:

1. Acceptable Manufacturers: Duro-Dyne Corp.; Erico Fastening Systems, Inc.

2. Type: Weld pins, complete with self-locking insulation retaining washers.

B. Pressure Sensitive Tape for Sealing Laminated Jackets:

1. Acceptable Manufacturers: Alpha Associates, Childers, Ideal Tape, Morgan Adhesive.

2. Type: Same construction as jacket.

C. Wire, Bands, and Wire Mesh:

1. Binding and Lacing Wire: Nickel copper alloy or copper clad steel.

2. Bands: Galvanized steel, 1/2" wide x 0.015 inch thick, with 0.032 inch thick galvanized wing seals.

3. Wire Mesh: Woven 20 gage steel wire with 1 inch hexagonal openings, galvanized after weaving.

D. Reinforcing Membrane: Glass or Polyester, 10 x 10 mesh. Alpha Associates Style 59, Childers Chil-Glas, Foster's MAST-A-FAB.

PART 3 EXECUTION

3.1 PREPARATION

A. Perform the following prior to starting insulation Work:

1. Install all hangers, supports, and appurtenances in their permanent locations.

2. Complete testing of piping.

3. Clean and dry all surfaces to be insulated.

3.2 INSTALLATION, GENERAL

A. Install the Work of this Section in accordance with manufacturer's printed installation instructions unless otherwise specified.

B. Provide continuous piping insulation and jacketing when passing thru interior wall, floor, and ceiling construction.

1. At Through Penetration Firestops: Coordinate insulation densities with the requirements of approved firestop system being installed. See Section 22 0515.

a. Insulation densities required by approved firestop system may vary with the densities specified in this Section. When this occurs use the higher density insulation.

C. Individual piping runs shall have consistent insulation type.

D. Apply Insulation to completely cover entire surface of piping. Do not insulate over weld certification stamps.

3.3 INSTALLATION AT HANGERS AND SUPPORTS

A. Reset and realign hangers and supports if they are displaced during insulation installation.

B. Install high density jacketed insulation inserts at hangers and supports for insulated piping as specified.

1. Insulation Inserts For Use with Fibrous Glass Insulation:

a. Where clevis hangers are used, install insulation shields and high density jacketed insulation inserts between shield and pipe.

b. Where insulation is subject to compression at points over 180 degrees apart, e.g. riser clamps, U-bolts, or trapezes, fully encircle pipe with 2 protection shields and 2 high density jacketed fibrous glass insulation inserts within supporting members.

1 Exception: Locations where pipe covering protection saddles are specified for hot service piping, 6 inch and larger.

3.4 INSTALLATION OF FIBROUS GLASS COLD SERVICE INSULATION

A. Install insulation materials with a field or factory applied ASTM C 1136 Type I laminated vapor barrier jacket, unless otherwise specified.

B. Piping:

1. Butt insulation joints together.

2. Continuously seal joints with minimum 1-1/2 inch wide self-sealing longitudinal jacket laps and 3-inch wide butt adhesive backed strips, or 3 inch wide pressure sensitive sealing tape of same material as jacket.

3. Bed insulation in a 2-inch wide band of vapor barrier mastic,and vapor seal exposed ends of insulation with vapor barrier mastic at each butt joint between pipe insulation and equipment, fittings or flanges at the following intervals:

a. Horizontal Pipe Runs: 21 ft.

b. Vertical Pipe Runs: 9 ft.

C. Fittings, Valves, Flanges and Irregular Surfaces:

1. Insulate with mitre cut or pre-molded fitting insulation of same material and thickness as adjoining pipe insulation.

2. Secure insulation in place with 16 gage wire, with ends twisted and turned down into insulation.

3. Butt fitting, valve, and flange insulation against pipe insulation and bond with insulating cement.

4. Insulate valves up to and including bonnets, without interfering with packing nuts.

5. Apply leveling coat of insulating cement to smooth out insulation and cover wiring.

6. When insulating cement has dried, seal fitting, valve and flange insulation by embedding a layer of reinforcing membrane of 4 oz. canvas jacket between 2 flood coats of vapor barrier mastic, each 1/8 inch thick wet.

7. Lap reinforcing membrane or canvas on itself and adjoining pipe insulation at least 2 inches.

8. Trowel, brush, or rubber glove outside coat over entire insulated surface.

D. Fittings, Valves, Flanges and Irregular Surfaces - Alternate:

1. Apply one piece pre-molded PVC fitting covers with fibrous glass insulation inserts with galvanized coated tack fasteners. Tape circumferential joint between insulation and premolded fitting cover with 2 inch wide pressure sensitive polyvinyl tape.

a. Exception: Provide additional insulation inserts on service operating at under 45 degrees F or where insulation thickness exceeds 1-1/2 inches. Ensure that insulation is adequate to prevent PVC fitting jacket temperature from falling below 45 degrees F.

3.5 INSTALLATION OF FIBROUS GLASS HOT SERVICE INSULATION

A. Install insulation materials with field or factory applied ASTM C 1136 Type I laminated vapor barrier jacket unless otherwise specified.

B. Canvas Jackets on Piping, Fittings, Valves, Flanges, Unions, and Irregular Surfaces:

1. For piping 2 inch size and smaller: 4 oz per sq yd unless otherwise specified.

2. For piping over 2 inch size: 6 oz per sq yd unless otherwise specified.

C. Piping:

1. Butt insulation joints together.

2. Continuously seal joints with minimum 1-1/2 inch wide self-sealing longitudinal jacket laps and 3-inch wide butt adhesive backed strips, or 3 inch wide pressure sensitive sealing tape of same material as jacket.

3. Fill voids in insulation at hanger with insulating cement.

4. Exceptions:

a. Piping in Accessible Shafts, Attic Spaces, Crawl Spaces, Unfinished Spaces, and Concealed Piping: Butt insulation joints together and secure with minimum 1-1/2" wide longitudinal jacket laps and 3 inch wide butt strips of same material as jacket, with outward clinching staples on maximum 4 inch centers. Fill voids in insulation at hangers with insulating cement.

b. Piping in Tunnels: Butt insulation joints together and secure with minimum 1-1/2" wide longitudinal jacket laps and 3 inch wide butt strips, of same material as jacket, with outward clinching staples on maximum 4 inch centers and 16 gage wires a minimum of 4 loops per section. Fill voids in insulation with insulating cement.

5. Fittings, Valves, Flanges and Irregular Surfaces:

a. Insulate with mitre cut or pre-molded fitting insulation of same material and thickness as adjoining pipe insulation.

b. Secure insulation in place with 16 gage wire, with ends twisted and turned down into insulation.

c. Butt fitting, valve, and flange insulation against pipe insulation and bond with insulating cement.

d. Insulate valves up to and including bonnets, without interfering with packing nuts.

e. Apply leveling coat of insulating cement to smooth out insulation and cover wiring.

f. When insulating cement has dried, coat insulated surface with lagging adhesive, and apply 4 oz. or 6 oz. canvas jacket as required by pipe size.

1 Lap canvas jacket on itself and adjoining pipe insulation at least 2 inches.

2 Size entire canvas jacket with lagging adhesive.

g. Exceptions:

1 Insulate fittings, valves, and irregular surfaces 3 inch size and smaller with insulating cement covered with 4 oz or 6 oz canvas jacket as required by pipe size. Terminate pipe insulation adjacent to flanges and unions with insulating cement, troweled down to pipe on a bevel.

2 Sizing of canvas surface is not required on fittings, valves, flanges, and irregular surfaces in concealed piping, piping in accessible shafts, attic spaces, crawl spaces, unfinished spaces, and tunnels.

6. Fittings, Valves, Flanges and Irregular Surfaces - Alternate:

a. Apply one piece pre-molded PVC fitting covers with fibrous glass insulation inserts with galvanized coated tack fasteners. Tape circumferential joint between insulation and premolded fitting cover with 2 inch wide pressure sensitive polyvinyl tape.

1 Exception: Provide additional insulation inserts on service operating at over 250 degrees F or where insulation thickness exceeds 1-1/2 inches. Ensure that insulation is adequate to prevent PVC fitting jacket temperature from exceeding 150 degrees F.

3.6 SCHEDULE OF PIPING INSULATION

A. Insulate all cold service and hot service piping, and appurtenances except where otherwise specified.

B. Plumbing Piping Systems (Provide with PVC fitting covers and inserts):

1. Domestic Hot Water Supply (105 to 140 degrees F):

a. Glass Fiber Insulation:

1 Pipe Size Range: Up to 1-1/4 inch.

(a) Thickness: 1 inch.

2 Pipe Size Range: Over 1-1/4 inch.

(a) Thickness: 1.5 inch.

2. Domestic Hot Water Recirculation (Provide with PVC fitting covers and inserts):

a. Glass Fiber Insulation:

1 Pipe Size Range: All sizes.

(a) Thickness: 1 inch.

3. Domestic Cold Water (Provide with PVC fitting covers and inserts):

a. Glass Fiber Insulation:

1 Pipe Size Range: All sizes.

(a) Thickness: 1/2 inch.

4. Plumbing Vents Within 10 Feet of the Exterior:

a. Glass Fiber Insulation:

1 Pipe Size Range: All sizes.

(a) Thickness: 1 inch.

3.7 SCHEDULE OF INSULATION JACKETING

A. Piping Exterior to Building: Jacket insulated piping with circumferentially corrugated aluminum jacketing.

1. Lap longitudinal and circumferential joints a minimum of 2 inches.

2. Secure jacketing in place with 1/2 inch c 0.020 thick aluminum bands secured with aluminum wing type seals, on maximum 12 inch centers.

3. Cover insulated fittings, valves, and offsets with mitered sections of jacketing. Seal joints with mastic, and secure with aluminum strapping and wing seals.

4. Factory fabricated, preformed fitting covers of same material as jacketing may be used instead of mitered jacketing.

5. Install jacketing to avoid trapping condensation and precipitation.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sanitary waste piping, above grade.

B. Chemical-resistant sanitary waste piping.

C. Domestic water piping, above grade.

1.2 RELATED REQUIREMENTS

A. Section 22 0516 - Expansion Fittings and Loops for Plumbing Piping.

B. Section 22 0529 - Hangers and Supports for Plumbing Piping and Equipment.

C. Section 22 0553 - Identification for Plumbing Piping and Equipment.

D. Section 22 0719 - Plumbing Piping Insulation.

E. Section 33 0110.58 - Disinfection of Water Utility Piping Systems.

1.3 REFERENCE STANDARDS

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2018.

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2018.

C. ASME B31.9 - Building Services Piping; 2020.

D. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2021.

E. ASTM B32 - Standard Specification for Solder Metal; 2020.

F. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2020.

G. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

H. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.

I. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2016.

J. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2020a.

K. ASTM C1053 - Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications; 2000 (Reapproved 2015).

L. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020.

M. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2020.

N. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2020.

O. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2016.

P. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

Q. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe; 2014 (Reapproved 2021).

R. ASTM F679 - Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings; 2016.

S. AWWA C651 - Disinfecting Water Mains; 2014, with Addendum (2020).

T. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2012.

U. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2012.

V. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2013.

W. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018 (Amendent 2019).

X. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

Y. NSF 61 - Drinking Water System Components - Health Effects; 2024.

Z. NSF 372 - Drinking Water System Components - Lead Content; 2024.

AA. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

B. Plenum-Installed Acid Waste Piping: Flame-spread index equal or below 25 and smoke-spread index equal or below 50 according to ASTM E84 or UL 723 tests.

2.2 SANITARY WASTE PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. Cast Iron Pipe: ASTM A74 extra heavy weight.

1. Fittings: Cast iron.

2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

B. PVC Pipe: ASTM D2665, ASTM D3034, or ASTM F679.

1. Fittings: PVC.

2. Joints: Push-on, using ASTM F477 elastomeric gaskets.

2.3 SANITARY SEWER PIPING AND VENT PIPING, ABOVE GRADE WHEN PENETRATING FIRE BARRIER.

A. Cast Iron Pipe: ASTM A74, service weight.

1. Fittings: Cast iron.

2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B. PVC Pipe: ASTM D2665. (NOTE: when installed in plenum space wrap PVC piping with Thermal Ceramics PlenumWrap+)

1. Fittings: PVC.

2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.4 CHEMICAL-RESISTANT SANITARY WASTE PIPING

A. Glass Pipe: ASTM C1053.

1. Fittings: ASTM C1053.

2. Joints: Stainless steel compression couplings with tetra-fluoroethylene seal ring.

B. PP Pipe: Polypropylene, flame retardant.

1. Fittings: Polypropylene.

2. Joints: Electrical resistance fusion.

2.5 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.

2. Joints: ASTM B32, alloy Sn95 solder.

3. Mechanical Press Sealed Fittings: Double-pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.

2.6 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.

3. Trapeze Hangers: Welded steel channel frames attached to structure.

4. Vertical Pipe Support: Steel riser clamp.

B. Plumbing Piping - Drain, Waste, and Vent:

1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (15 to 40 mm, DN): Malleable iron, adjustable swivel, split ring.

2. Hangers for Pipe Sizes 2 inch (50 mm, DN) and Over: Carbon steel, adjustable, clevis.

3. Wall Support for Pipe Sizes to 3 inch (80 mm, DN): Cast iron hook.

4. Wall Support for Pipe Sizes 4 inch (100 mm, DN) and Over: Welded steel bracket and wrought steel clamp.

C. Plumbing Piping - Water:

1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (15 to 40 mm, DN): Malleable iron, adjustable swivel, split ring.

2. Hangers for Cold Pipe Sizes 2 inch (50 mm, DN) and Over: Carbon steel, adjustable, clevis.

3. Hangers for Hot Pipe Sizes 2 to 4 inch (50 to 100 mm, DN): Carbon steel, adjustable, clevis.

D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:

1. Concrete Wedge Expansion Anchors: Comply with ICC-ES AC193.

2. Masonry Wedge Expansion Anchors: Comply with ICC-ES AC01.

3. Concrete Screw Type Anchors: Comply with ICC-ES AC193.

4. Masonry Screw Type Anchors: Comply with ICC-ES AC106.

2.7 BALL VALVES

A. Manufacturers:

1. Conbraco Industries, Inc: www.apollovalves.com.

2. Grinnell Products, a Tyco Business: www.grinnell.com.

3. Shurjoint Piping Products, Inc., a Tyco Business: www.shurjoint.com.

4. Nibco, Inc: www.nibco.com.

5. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Construction, 4 Inches (100 mm) and Smaller: MSS SP-110, Class 150, 400 psi (2760 kPa) CWP, bronze body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder or threaded ends with union.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 22 0516.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

H. Provide access where valves and fittings are not exposed.

I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.

J. Install bell and spigot pipe with bell end upstream.

K. Install valves with stems upright or horizontal, not inverted. See Section 22 0523.

L. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

M. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

N. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9.

2. Support horizontal piping as indicated.

3. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.

4. Place hangers within 12 inches (300 mm) of each horizontal elbow.

5. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.

7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

8. Provide copper plated hangers and supports for copper piping.

9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

10. Support cast iron drainage piping at every joint.

O. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.3 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.4 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch (10 mm) vertically of location indicated and slope to drain at minimum of 1/4 inch per foot (1:50) slope.

B. Water Piping: Slope at minimum of 1/32 inch per foot (1:400) and arrange to drain at low points.

3.5 FIELD TESTS AND INSPECTIONS

A. Verify and inspect systems according to requirements by the Authority Having Jurisdiction. In the absence of specific test and inspection procedures proceed as indicated below.

B. Domestic Water Systems:

1. Perform hydrostatic testing for leakage prior to system disinfection.

2. Test Preparation: Close each fixture valve or disconnect and cap each connected fixture.

3. General:

a. Fill the system with water and raise static head to 10 psi (345 kPa) above service pressure. Minimum static head of 50 to 150 psi (345 to 1,034 kPa). As an exception, certain codes allow a maximum static pressure of 80 psi (551.6 kPa).

C. Test Results: Document and certify successful results, otherwise repair, document, and retest.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed, and clean.

B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.7 SCHEDULES

A. Pipe Hanger Spacing:

1. Metal Piping:

a. Pipe Size: 1/2 inch (15 mm, DN) to 1-1/4 inch (32 mm, DN):

1 Maximum Hanger Spacing: 6.5 ft (2 m).

2 Hanger Rod Diameter: 3/8 inches (9 mm).

b. Pipe Size: 1-1/2 inch (40 mm, DN) to 2 inch (50 mm, DN):

1 Maximum Hanger Spacing: 10 ft (3 m).

2 Hanger Rod Diameter: 3/8 inch (9 mm).

c. Pipe Size: 2-1/2 inch (65 mm, DN) to 3 inch (80 mm, DN):

1 Maximum Hanger Spacing: 10 ft (3 m).

2 Hanger Rod Diameter: 1/2 inch (13 mm).

2. Plastic Piping:

a. All Sizes:

1 Maximum hanger spacing: 4 ft.

2 Hanger Rod Diameter: 3/8 inch (9 mm).

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Drains.

B. Cleanouts.

C. Water hammer arrestors.

1.2 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping.

1.3 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASME A112.6.3 - Floor and Trench Drains; 2019.

C. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2020.

D. NSF 61 - Drinking Water System Components - Health Effects; 2024.

E. NSF 372 - Drinking Water System Components - Lead Content; 2024.

F. PDI-WH 201 - Water Hammer Arresters; 2017.

1.4 SUBMITTALS

A. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

B. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.2 DRAINS

A. Manufacturers:

1. Acudor Platinum, a division of Acudor: www.acudorplatinum.com/#sle.

2. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.

3. Josam Company: www.josam.com/#sle.

4. LATICRETE International, Inc; LATICRETE® HYDRO BAN® Linear Drain: www.laticrete.com/#sle.

5. LATICRETE International, Inc; LATICRETE® HYDRO BAN® Bonding Flange Drain: www.laticrete.com/#sle.

6. Zurn Industries, LLC: www.zurn.com/#sle.

B. Floor Drain:

1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.

2.3 CLEANOUTS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.

2. Josam Company: www.josam.com.

3. Zurn Industries, LLC: www.zurn.com.

4. Watts

B. Cleanouts at Interior Finished Floor Areas:

1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

C. Cleanouts at Interior Finished Wall Areas:

1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

2.4 WATER HAMMER ARRESTORS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.

2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com.

3. Zurn Industries, LLC: www.zurn.com.

B. Water Hammer Arrestors:

1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F (minus 73 to 149 degrees C) and maximum 250 psi (1700 kPa) working pressure.

2.5 MIXING VALVES

A. Thermostatic Mixing Valves:

1. Valve: Chrome-plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment.

2. Accessories:

a. Check valve on inlets.

b. Volume control shut-off valve on outlet.

c. Stem thermometer on outlet.

d. Strainer stop checks on inlets.

3. Cabinet: 16 gauge, 0.0598 inch (1.52 mm) prime-coated steel, for recessed mounting with keyed lock.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Install floor cleanouts at elevation to accommodate finished floor.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sinks.

B. Electric water coolers.

C. Service sinks.

D. Emergency showers.

1.2 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping.

B. Section 22 1006 - Plumbing Piping Specialties.

1.3 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2008 (Reaffirmed 2013).

C. ASME A112.18.1 - Plumbing Supply Fittings; 2018, with Errata.

D. NSF 61 - Drinking Water System Components - Health Effects; 2024.

E. NSF 372 - Drinking Water System Components - Lead Content; 2024.

1.4 SUBMITTALS

A. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

B. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

C. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.6 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for electric water cooler.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 SINKS - (SINK-A)

A. Sink Manufacturers:

1. American Standard, Inc: www.americanstandard-us.com.

2. Kohler Company: www.kohler.com.

3. Elkay: www.elkay.com

B. SINK-A: Single Compartment Bowl: ASME A112.19.3;302 stainless steel, self rimming and undercoated, with ledge back drilling for trim.

1. Drain: 1-1/2 inch (38 mm) chromed brass drain.

C. Supply Faucet: ASME A112.18.1; chrome plated combination supply fitting, water economy aerator with maximum flow of 2.2 gallons per minute, lever handles.

2.3 ELECTRIC WATER COOLERS

A. Electric Water Cooler Manufacturers:

1. Elkay Manufacturing Company: www.elkay.com/#sle.

2. Haws Corporation: www.hawsco.com/#sle.

3. Oasis, a Lynn Tilton Company: www.oasiscoolers.com/#sle.

B. Water Cooler: Electric, mechanically refrigerated; surface mounted, ADA compliant; stainless steel top, vinyl on steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket; integral air cooled condenser and stainless steel grille.

1. Capacity: 8 gph (30.3 Lph) of 50 degrees F (10 degrees C) water with inlet at 80 degrees F (27 degrees C) and room temperature of 90 degrees F (32 degrees C), when tested in accordance with ASHRAE Std 18.

2. Electrical: 115 VAC, 60 Hertz compressor, 6 foot (2 m) cord and plug for connection to electric wiring system including grounding connector.

C. Bottle Filler: Materials to match fountain.

2.4 SERVICE SINKS

A. Service Sink Manufacturers:

1. American Standard, Inc: www.americanstandard-us.com/#sle.
2. Commercial Enameling Company: www.cecosinks.com/#sle.
3. Elkay Manufacturing Company: www.elkay.com/#sle.
4. Zurn Industries, Inc; _____: www.zurn.com/#sle.

B. Bowl: #14 gauge, type 304, (18-8) stianless steel scullery sink. Compartments 14" deep. Welded 1/4" radius coved corner construction. Welds are ground to a smooth and cleanable finish. Full length 8" high backsplash with 45 Degree sloped top. 1-1/2" wide inward sloping top channel rims.

C. Two-Lever Handle Service Faucet:

1. Type: Wall-mount spout faucet with union inlets and mounting plate.
2. ASME A112.18.1, ADA Standards, and NSF 61 compliant assembly.
3. Materials: Ceramic disc cartridge valve on brass body with polished chrome finish.

2.5 EMERGENCY SHOWERS

A. Manufacturers:

1. Haws Corporation: www.hawsco.com/#sle.
2. Therm-Omega-Tech, Inc: www.thermomegatech.com/#sle.
3. Guardian Equipment:www.gesafety.com.

B. Emergency Shower:

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome-plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall supports and bolts.

3.4 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.5 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

A. Clean plumbing fixtures and equipment.

3.7 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.1 WORK INCLUDED

A. Provide all labor, tools, materials, accessories, parts, transportation, taxes, and related items, essential for installation of the work and necessary to make work complete and operational. Provide new equipment and material unless otherwise called for. References to codes, specifications, and standards called for in the specification sections and on the drawings mean the latest edition, amendment, and revision of such referenced standard in effect on the date of these contract documents.

1.2 LICENSING

A. The Contractor shall hold a license to perform the work as issued by the local jurisdiction.

B. The Contractor shall be responsible for reviewing the local jurisdiction requirements prior to bidding.

1.3 PERMITS

A. Apply for and obtain all required permits and inspections, pay all fees and charges including all service charges.

1.4 CODE COMPLIANCE

A. Provide work in compliance with the following:

1. The Building Code of New York State including The Fire Code; Property Maintenance Code; Plumbing Code, Mechanical Code and Fuel Gas Code; and The Energy Code of New York.
2. New York State Department of Labor Rules and Regulations.
3. Occupational Safety and Health Administration (OSHA).
4. National Fuel Gas Code, NFPA 54.
5. National Electrical Code, NFPA 70.
6. Local Codes and Ordinances.
7. Life Safety Codes, NFPA 101 (2003).
8. New York Board of Fire Underwriters.
9. Part 4 of Title 12 Rules and Regulations of the State of New York Industrial Code Rule No. 4 (12NYCRR4)
10. New York State Education Department “Manual of Planning Standards”.

1.5 GLOSSARY

A. AGA American Gas Association

B. AMCA Air Moving and Conditioning Association, Inc.

C. ANSI American National Standards Institute

D. ASHRAE American Society of Heating, Refrigeration, and Air Conditioning Engineers, Inc.

E. ASME American Society of Mechanical Engineers

F. ASPE American Society of Plumbing Engineers

G. ASTM American Society for Testing Materials

H. FM Factory Mutual Insurance Company

I. IBR Institute of Boiler & Radiation Manufacturers

J. NFPA National Fire Protection Association

K. NYS/UFPBC New York State Uniform Fire Prevention and Building Code

1.6 SHOP DRAWINGS/PRODUCT DATA/SAMPLES

A. Submit Shop Drawings on all items of equipment and materials to be furnished and installed. Submission of Shop Drawings and samples shall be accompanied by a transmittal letter, stating name of project and contractor, number of drawings, titles, and other pertinent data called for in individual sections. Shop Drawings shall be dated and contain: Name of project; name of prime professional; name of prime contractor; description or names of equipment, materials and items; and complete identification of locations at which materials or equipment are to be installed. Individual piecemeal or incomplete submittals will not be accepted. Similar items, (all types specified) shall be submitted at one time. Number each submittal by trade. Indicate deviations from contract requirements on Letter of Transmittal. Shop Drawings will be given a general review only. Corrections or comments made on the Shop Drawings during the review do not relieve Contractor from compliance with requirements of the drawings and specifications. The Contractor is responsible for: confirming and correcting all quantities; checking electrical characteristics and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner.

B. See Specification Section 01 3000 Administrative requirements for Submittal procedures.

1.7 PROTECTION OF PERSONS AND PROPERTY

A. Contractor shall assume responsibility for construction safety at all times and provide as part of contract all trench or building shoring, scaffolding, shielding, dust/fume protection, mechanical/electrical protection, special grounding, safety railings, barriers, and other safety features required to provide safe conditions for all workmen and site visitors.

1.8 EQUIPMENT ARRANGMENTS

A. The contract documents are prepared on basis of one manufacturer as “design equipment,” even though other manufacturer’s names are listed as acceptable makes. If Contractor elects to use one of the listed makes other than “design equipment,” submit detailed drawings, indicating proposed installation of equipment. Show maintenance arrangement. Make required changes in the work of other trades, at no increase in any contract. Provide larger motors, feeders, breakers, and equipment, additional control devices, valves, fittings and other miscellaneous equipment required for proper operation, and assume responsibility for proper location of roughing and connections by other trades. Remove and replace door frames, access doors, walls, ceilings, or floors required to install other than design make equipment. If revised arrangement submittal is rejected, revise and resubmit specified “design equipment” item which conforms to contract documents.

1.9 CONTINUITY OF SERVICES

A. The building will be in use during construction operations. Maintain existing systems in operation within all rooms of building at all times. Refer to “General Conditions of the Contract for Construction” for temporary facilities for additional contract requirements. Schedules for various phases of contract work shall be coordinated with all other trades and with Owner’s Representative. Provide, as part of contract, temporary mechanical connections and relocations as required to accomplish the above. Obtain approval in writing as to date, time, and location for shutdown of existing mechanical facilities or associated services.

1.10 ROUGHING

A. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevation, interferences, etc. Make necessary changes in contract work, equipment locations, etc., as part of a contract to accommodate work to obstacles and interferences encountered. Before installing, verify exact location and elevations at work site. DO NOT SCALE plans. If field conditions, details, changes in equipment or shop drawing information require an important rearrangement, report same to Owner's Representative for review. Obtain written approval for all major changes before installing.

B. Install work so that items both existing and new are operable and serviceable. Eliminate interference with removal of coils, motors, filters, belt guards and/or operation of doors. Provide easy, safe, and code mandated clearances at controllers, motor starters, valve access, and other equipment requiring maintenance and operation. Where Contractor could not reasonably be expected to find such trade interferences due to concealment in walls, ceiling or floors, such relocations will be done by Change Order, if not, included in contract work. Contractor shall relocate existing work in way of new construction. VISIT SITE BEFORE BIDDING TO DETERMINE SCOPE OF WORK SINCE FEW OF SUCH ITEMS CAN BE SHOWN. Provide new materials, including new piping and insulation for relocated work.

C. Coordinate work with other trades and determine exact route or location of each duct, pipe, conduit, etc., before fabrication and installation. Coordinate with Architectural Drawings. Obtain from Owner's Representative exact location of all equipment in finished areas, such as thermostat, fixture, and switch mounting heights, and equipment mounting heights. Coordinate all work with the architectural reflected ceiling plans and/or existing Architecture. Mechanical drawings show design arrangement only for diffusers, grilles, registers, air terminals, and other items. Do not rough-in contract work without reflected ceiling location plans.

D. Before roughing for equipment furnished by Owner or in other contracts, obtain from Owner and other Contractors, approved roughing drawings giving exact location for each piece of equipment. Do not "rough in" services without final layout drawings approved for construction. Cooperate with other trades to insure proper location and size of connections to insure proper functioning of all systems and equipment. For equipment and connections provided in this contract, prepare roughing drawing as follows:

1. Existing equipment: Measure the existing equipment and prepare for installation in new location.

2. New equipment: Obtain equipment roughing drawings and dimensions, then prepare roughing-in-drawings. If such information is not available in time, obtain an acknowledgement in writing, then make space arrangements as required with Owner's Representative.

1.11 REMOVAL WORK

A. Where existing equipment removals are called for, submit complete list to Owner's Representative. All items that Owner wishes to retain that do not contain asbestos or PCB Material shall be delivered to location directed by Owner. Items that Owner does not wish to retain shall be removed from site and legally disposed of. Removal and disposal of material containing asbestos and/or PCB's shall be in accordance with Federal, State, and Local law requirements. Where equipment is called for to be relocated, contractor shall carefully remove, clean and recondition, then reinstall. Removal all abandoned piping, equipment, ductwork, tubing, supports, fixtures, etc. Visit each room, crawl space, and roof to determine the total Scope of Work. The disturbance or dislocation of asbestos-containing materials causes asbestos fibers to be released into the building's atmosphere, thereby creating a health hazard to workmen and building occupants. Consistent with Industrial Code Rule 56 and the content of recognized asbestos-control work, the Contractor shall apprise all of his workers, supervisory personnel, subcontractors, Owner and Consultants who will be at the job site of the seriousness of the hazard and of proper safeguards and work procedures which must be followed, as described in New York State Department of Labor Industrial Code Rule 56.

1.12 EQUIPMENT AND MATERIAL INSTALLATION

A. Provide materials that meet the following minimum requirements:

1. Materials shall have a flame spread rating of 25 or less and smoke developed rating of 50 or less, in accordance with NFPA 255.

2. All equipment and material for which there is a listing service shall bear a UL label.

3. Gas-fired equipment and system shall meet AGA Regulations and shall have AGA label.

4. Mechanical and electrical equipment and systems with electrical components shall be UL Listed and meet UL Standards and requirements of the NEC.

1.13 CUTTING AND PATCHING

A. Mechanical trade shall include their required cutting and patching work unless shown as part of the General Construction work on the architectural drawings. Refer to "General Conditions of the Contract for Construction," for additional requirements. Cut and drill from both sides of walls and/or floors to eliminate splaying. Patch any cut or abandoned holes left by removals of equipment, fixtures, etc. Patch adjacent existing work disturbed by installation of new work including insulation, walls and wall covering, ceiling and floor covering, other finished surfaces. Patch openings and damaged areas equal to existing surface finish. Cut openings in prefabricated construction units in accordance with manufacturer's instructions.

1.14 PAINTING

A. Include painting for patchwork with color to match adjacent surfaces. Where color cannot be adequately matched, paint entire surface. Provide one (1) coat of primer and two (2) finish coats or as called for in the Mechanical Specifications. Refer to General Construction Specifications for additional information.

1.15 CONCEALMENT

A. Conceal all contract work above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, notify Owner's Representative before starting that part of the work and install only after his review. In areas with no ceilings, install only after Owner's Representative reviews and comments on arrangement and appearance.

1.16 CHASES

A. In Existing Buildings:

1. Drill holes for floor and/or roof slab openings.

2. Multiple pipes smaller than 1" properly spaced and supported may pass through one 6" or smaller diameter opening.

3. Seal voids in fire rated assemblies with a fire-stopping seal system to maintain the fire resistance of the assembly. Provide 18 gauge galvanized sleeves at fire rated assemblies. Extend sleeves 2" above floors.

4. In wall openings, drill or cut holes to suit. Provide 18 gauge galvanized sleeves at shafts and fire rated assemblies. Provide fire-stopping seal between sleeves and wall in drywall construction. Provide fire-stopping similar to that for floor openings.

1.17 FLASHING, SEALING, FIRE-STOPPING

A. See Specification Section 23 0515 - Mechanical Firestopping.

1.18 SUPPORTS

A. Provide required supports, beams, angles, hangers, rods, bases, braces, and other items to properly support contract work. Supports shall meet the approval of the Owner's Representative. Modify studs, add studs, add framing, or otherwise reinforce studs in metal stud walls and partitions as required to suit contract work. If necessary, in stud walls, provide special supports from floor to structure above. For Precast Panels/Planks and Metal Decks, support mechanical/electrical work as determined by manufacturer and Owner's Representative. Provide heavy gauge steel mounting plates for mounting contract work. Mounting plates shall span two or more studs. Size, gauge, and strength of mounting plates shall be sufficient for equipment size, weight, and desired rigidity.

1.19 ACCESS PANELS

A. Access panels shall be furnished by the Mechanical Trade and installed by General Contractor. Location and size shall be the responsibility of Mechanical Trade. Bear cost of construction changes necessary due to improper information or failure to provide proper information in ample time. Access panels over 324 square inches shall have two cam locks. Contractor shall provide proper frame and door type for various wall or ceiling finishes. Access panels shall be equal to “Milcor” as manufactured by Inland Steel Products Co., Milwaukee, Wisconsin. Provide General Contractor with a set of architectural black and white prints with size and approximate locations of access panels shown.

1.20 CONCRETE BASES

A. Provide concrete bases for all floor-mounted equipment (unless otherwise noted). Provide 3,000 lb. concrete, chamfer edges, trowel finish, and securely bond to floor by roughening slab and coating with cement grout. Bases 4” high (unless otherwise indicated); shape and size to accommodate equipment. Set anchor bolts in sleeves before pouring and after anchoring and leveling, fill equipment bases with grout.

1.21 HVAC EQUIPMENT CONNECTIONS

A. Mechanical contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

B. Provide final hydronic, steam, drain, vent, and gas connections to all equipment as required by the equipment. Provide final connections, including domestic water piping, controls, and devices from equipment to outlets left by other trades. Provide equipment waste, drip, overflow and rail connections extended to floor drains.

C. Provide for Owner furnished and contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, insulation, sheet metal work, controls, dampers, as required.

D. Coordinate locations. When gas or fuel oil piping is provided for Mechanical Units by other contractors or trades, the final connection to the Mechanical Unit is the responsibility of the Division 23 Contractor. Coordinate locations.

E. It is the general intent that all electrical power wiring, motor starters and/or power disconnects be provided and installed by the Division 26 Contractor. Some mechanical equipment is specified to have factory-installed integral starters and/or power disconnects and as such, are to be provided by the Division 23 Contractor. REFER TO THE MOTOR CONNECTION SCHEDULE FOR ALL REQUIREMENTS.

F. Duct Smoke Detectors are furnished and wired by the Division 26 Contractor, installed in the duct by the Division 23 Contractor

1.22 DELIVERY

A. Accept materials delivered on site in manufacturer's packaging, labeled with manufacturer's identification and product information.

1.23 STORAGE AND PROTECTION OF MATERIALS

A. Store materials on dry base, at least 6” above-ground or floor. Store so as not to interfere with other work or obstruct access to buildings or facilities. Provide waterproof/windproof covering. Remove and provide special storage for items subject to moisture damage. Protect against theft or damage from any cause. Replace items stolen or damaged, at no cost to Owner.

B. Maintain ambient conditions for each product as required by each manufacturer from time of delivery. Maintain appropriate ambient conditions for installation as recommended by each manufacturer for a minimum of 24 hours prior and 24 hours after installation.

C. Refer to “General Conditions of the Contract for Construction.”

1.24 FREEZING AND WATER DAMAGE

A. Take all necessary precautions with equipment, systems and building to prevent damage due to freezing and/or water damage. Repair or replace, at no charge in contract, any such damage to equipment, systems, and building. Perform first seasons winterizing in presence of Owner's operating staff.

1.25 OWNER INSTRUCTIONS

A. Before final acceptance of the work, furnish necessary skilled labor to operate all systems by seasons. Instruct designated person on proper operation, and care of systems/equipment. Repeat instructions, if necessary. Obtain written acknowledgement from person instructed prior to final payment. Contractor is fully responsible for system until final acceptance, even though operated by Owner's personnel, unless otherwise agreed in writing. List under clear plastic, operating, maintenance, and starting precautions procedures to be followed by Owner for operating systems and equipment.

1.26 MAINTENANCE MANUALS

A. Prepare Instructions and Maintenance Portfolios. Include one copy of each of approved Shop Drawings, wiring diagrams, piping diagrams spare parts lists, as-built drawings and manufacturer's instructions. Include typewritten instructions, describing equipment, starting/operating procedures, emergency operating instructions, summer-winter changeover, freeze protection, precautions and recommended maintenance procedures. Include name, address, and telephone number of supplier manufacturer representative and service agency for all major equipment items in a three ring binder with name of project on the cover. Deliver to Owner's Representative before request for final acceptance.

1.27 RECORD DRAWINGS

A. The Contractor shall obtain at his expense one (1) set of construction Contract Drawings including non-reproducible black and white prints for the purpose of recording record conditions.

B. The Contractor shall perform all survey work required for the location and construction of the work and to record information necessary for completion of the record drawings. Record drawings shall show the actual location of the constructed facilities in the same manner as was shown on the bid drawings. All elevations and dimensions shown on the drawings shall be verified or corrected so as to provide a complete and accurate record of the facilities as constructed.

C. It shall be the responsibility of the Contractor to mark each sheet of the non-reproducible drawings in pencil and to record thereon in a legible manner, any and all approved field changes and conditions as they occur. A complete file of approved field sketches, diagrams, and other changes shall also be maintained. At completion of the work, each sheet of record prints, plus all approved field sketches and diagrams shall be used in preparation of the record drawings.

D. Completed drawings shall be certified as reflecting record conditions and submitted to the engineer for approval.

1.28 ADDITIONAL ENGINEERING SERVICES

A. In the event that the Consultant is required to provide additional engineering services as a result of substitution of equivalent materials or equipment by the Contractor, or changes by the Contractor in dimension, weight, power requirements, etc., of the equipment and accessories furnished, or if the Consultant is required to examine and evaluate any changes proposed by the Contractor for the convenience of the Contractor, then the Consultant's expenses in connection with such additional services shall be paid by the Contractor and may be deducted from any monies owed to the Contractor.

1.29 FINAL INSPECTION

A. Upon completion of all punch list items, the Contractor shall provide a copy of the punch list back to the Architect/Engineer with each items noted as completed or the current status of the item. Upon receipt, the Architect/Engineer will schedule a final inspection.

1.30 ALL TRADES TEMPORARY HEAT

A. Refer to the Standard General Conditions of the contract for Construction and Supplemental General Conditions.

1.31 HVAC MAINTENANCE OF SYSTEMS DURING TEMPORARY USE PERIODS

A. Provide each air handling system with a set of prefilters in addition to the permanent filters. Furnish four sets of prefilters for each system for use when system is operated for temporary heating or cooling. During such use, change prefilters as often as directed by Owner's Representative. Provide necessary temporary throw away filters in all return openings to keep dust out of ductwork. Change as often as necessary. Remove all such temporary filters upon completion. Use supply units only. Do not operate return fans.

B. Blank-off outside air intake opening during temporary heating period. Install first set of permanent filters and prefilters.

C. Adjust dampers on supply system.

D. Set all heating coil control valves for manual operation.

E. Do not install any grilles or diffusers at room terminal ends of ducts until permission is given.

F. Assume responsibility for systems and equipment at all times, even though used for temporary heat or ventilating. Repair or replace all dented, scratched or damaged parts of systems prior to final acceptance.

G. Remove concrete, rust, paint spots, other blemishes, then clean.

H. Just prior to final acceptance, remove used final filter. Deliver all unused sets of prefilters to the Owner and obtain written receipt. Properly lubricate system bearings before and during temporary use. Maintain thermostats, freeze stats, overload devices, and all other safety controls in operating condition.

1.32 CLEANING

A. It is the Contractor's responsibility to keep clean all equipment and fixtures provided under this contract for the duration of the project. Each trade shall keep the premises free from an accumulation of waste material or rubbish caused by his operations. The facilities require an environment of extreme cleanliness, and it is the Contractor's responsibility to adhere to the strict regulations regarding procedures on the existing premises. After all tests are made and installations completed satisfactorily:

B. Thoroughly clean entire installation, both exposed surfaces and interiors.

C. Remove all debris caused by work.

D. Remove tools, surplus, materials, when work is finally accepted.

1.33 SYSTEM START-UP AND TESTING

A. All new heating and ventilating shall be started up and operated at normal operating temperature for a period of 24 hours to "bake-off" the equipment. The associated ventilation system shall run on 100% outside air during the bake-off for an additional eight hours to purge the building. This work shall be completed prior to building occupancy or if the work is not completed in time for summer "bake-off" on a Saturday with the Contractor responsible for being on site during the entire purge and bake-off operation.

B. Work of any contract which includes system "bake-off", system start-up, system cut-over or staff training shall not be done one week prior to and one week after the opening of the building/addition except upon written approval by the Owner.

C. Start-up and testing of HVAC systems shall occur while the building is not occupied by Owner and only after notice to the Project Inspector is made at least 24 hours in advance. The Mechanical Contractor shall be responsible for providing temporary filter media over all supply air registers and diffusers during the HVAC system start-up procedure. The Mechanical Contractor shall

provide airtight plastic covers over all supply and return air openings prior to the start of construction by any Contractor. The plastic shall be maintained airtight throughout the project construction and removed only with the approval of the Project Inspector.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Firestopping materials.

B. Firestopping of all penetrations, openings, and interruptions to fire rated assemblies, whether indicated on drawings or not, including but not limited to piping, tubing, ductwork and similar utilities passing through or penetrating fire rated walls and floor assemblies.

1.2 RELATED SECTIONS

A. Refer to "Code Compliance Drawings" for location of fire rated assemblies. At a minimum all corridor walls and all floors between stories have a 1hour rating.

1.3 REFERENCES

A. ASTM International:

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

2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

B. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.

C. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.

2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

3. UL 1479 - Fire Tests of Through-Penetration Firestops.

4. UL - Fire Resistance Directory.

D. Mechanical Code of Pennsylvania.

1.4 FIRE-STOP SYSTEM PERFORMANCE REQUIREMENTS

A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration fire-stop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire walls, fire partitions, fire barriers and smoke barriers.

2. Fire-resistance-rated horizontal assemblies including floors and ceiling membranes of roof/ceiling assemblies.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each through-penetration fire-stop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include fire-stop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated. Submit UL Standard detail for each penetration type proposed.

1.6 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs which provide the specified fire ratings when tested in accordance with methods indicated.

1. Listing in the current-year classification or certification books of UL will be considered as constituting an acceptable test report.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Hilti.

B. Nelson Fire Stop Products.

C. Specified Technology.

D. 3M Fire Protection Products.

E. Approved equals meeting UL requirements.

2.2 MATERIALS

A. Sealant Firestopping:

1. Intumescent firestop sealant designed to expand when exposed to fire.

2. Paintable

3. Fire Resistance: Up to 4 hours

4. Curing Time: 14-21 days

5. Elongation: 5%

6. Density: 1.5 g/cm3

7. Product: FS-ONE Intumescent Firestop Sealant manufactured by Hilti USA.

8. Uses: Insulated and uninsulated metal pipes, with or without sleeve, jacketed cables, cable bundles, plastic pipes, sheet metal duct, and top of wall joints.

B. Silicone Sealant Firestopping:

1. Silicone based firestop sealant that provides maximum movement in fire-rated joint applications and pipe penetrations.

2. Not paintable

3. Fire Resistance: Up to 4 hours

4. Elongation: 25%

5. Product: CP 601S Elastomeric Firestop Sealant manufactured by Hilti USA.

6. Uses: Joints in walls, floor to floor or fire compartments.

C. Safing Insulation:

1. Mineral-wool type insulation.

2. Thickness: 1" to 1-1/2"

3. Density: 4 to 8 pcf

4. Product: THERMAFIBER Safing Insulation

D. Sleeves:

1. Provide sleeves as required by section 1206.4 of the Mechanical Code.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration fire-stop systems to comply with fire-stop system manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration fire-stop systems.

2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration fire-stop systems. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration fire-stop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General

1. Install materials in manner described in UL Detail and in accordance with manufacturer's instructions, completely closing openings.

B. Installation

1. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

2. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

3. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.

4. Fire Rated Surface:

a. Seal opening at floor, wall, partition, and roof as follows:

1 Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.

2 Size sleeve allowing minimum of 1 inch void between sleeve and building element.

3 Pack void with backing material.

4 Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

b. Where piping, ductwork, cables, etc. penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.

5. Non-Rated Surfaces:

a. Seal opening through non-fire rated wall, floor, ceiling, and roof opening as follows:

1 Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.

2 Size sleeve allowing minimum of 1 inch void between sleeve and building element.

3 Install type of firestopping material recommended by manufacturer.

b. Install floor plates or ceiling plate where piping penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.

c. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of pipe and tighten in place, in accordance with manufacturer's instructions.

d. Interior partitions: Seal pipe penetrations at mechanical rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

C. Identification:

1. Identify through-penetration fire-stop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the fire-stop systems so that labels will be visible to anyone seeking to remove penetrating items or fire-stop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:

a. The words "Warning - Through-Penetration Fire-Stop System - Do Not Disturb. Notify Building Management of Any Damage."

b. Date of installation.

c. Through-penetration fire-stop system manufacturer's name.

3.4 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration fire-stop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration fire-stop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration fire-stop systems immediately and install new materials to produce systems complying with specified requirements.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flexible pipe connectors.

B. Expansion compensators.

C. Manufactured pipe loops.

1.2 RELATED REQUIREMENTS

A. Section 23 2113 - Hydronic Piping.

1.3 REFERENCE STANDARDS

A. ASTM A 269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2008.

B. EJMA (STDS) - EJMA Standards; Expansion Joint Manufacturers Association; 2003.

1.4 SUBMITTALS

A. Product Data:

1. Manufacturer's catalog sheets, specifications and installation instructions.

2. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.

3. Expansion Compensators: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

PART 2 PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS

A. Manufacturers:

1. Flex-Hose Co. Inc.

2. Metraflex Company.

3. Keflex / Flex-Weld Inc.

B. Design for a working pressure of 125 psig, when used in systems operating at pressures up to 125 psig, and for higher working pressures to correspond with the pressure in the piping for pressures over 125 psig.

1. Furnish end fittings to correspond to the end connections of the piping in which installed.

C. Bronze Units: Fabricate of seamless flexible tin bronze tubing, with a bronze wire braided outer jacketing of the same material as the tubing, silver brazed or welded to end fittings.

D. Stainless Steel Units: Fabricate of seamless flexible Type 321 steel tubing, with a stainless steel wire braided outer jacketing of the same material as the tubing, welded to steel end fittings.

2.2 MANUFACTURED PIPE LOOPS

A. Manufacturers:

1. Flex-Hose Co. Inc.
2. Metraflex Company.
3. Approved Equal.

B. General:

1. Manufacture pipe loops from three equal length sections of annular corrugated bronze close-pitch hose with bronze over braid which will absorb or compensate for pipe movements in all six degrees of freedom simultaneously.

C. Design Criteria:

1. Braided bronze loops must be suitable for operating temperatures up to 400ºF. Loops must be designed for pressure testing to 1.5 times their rated working pressure and a minimum 4:1 (burst to working) safety factor. Each braided bronze loop must be individually leak tested by the manufacturer using a liquid dye-penetrant. Guarantee loops will be covered by the manufacturer's three (3) year full replacement warranty when installed in accordance with manufacturer's specifications and installation instructions.

D. Fabrication:

1. The corrugated metal hose, braids, fittings, and a copper ring-ferrule/band (material gauge not less than .032") must be integrally seal-welded using a 100% circumferential oxy-acetylene process with phos-copper filler. End fittings shall be copper female sweat. Loops shall be prepared for shipment using a cut-to-length metal shipping bar, tacked securely between the elbows of the two parallel legs, to maintain the manufactured length during shipping.

2.3 EXPANSION COMPENSATORS

A. Manufacturers:

1. Flex-Hose Co. Inc.
2. Metraflex Company.
3. Keflex / Flex-Weld Inc.

B. General:

1. Provide shrouded bellows type with internal guides and limit stops.

C. Design Criteria:

1. Design compensators for a 125 psig working pressure exterior to the bellows, with a minimum compression stroke of 1-3/4" and 1/4" extension from the factory setting. Guarantee rate of life of compensators at not less than 10,000 full rated traverse cycles, when tested at 150 psig and 406 degrees F.

D. Fabrication:

1. Compensators shall be multi-ply 18-8 chrome nickel stainless steel bellows for ferrous units and multi-ply seamless phosphor bronze for brass units. Furnish shrouds, end fittings, and internal trim of heavy carbon steel for stainless steel bellows units and brass for bronze bellows units. Furnish ferrous units of all welded construction and brass or bronze units of silver soldered (brazed) construction. Provide a positive, internal anti-torque device as an integral part of each compensator and a positioning clip properly located to insure correct installation, so as to allow for full specified traverse movement.

2.4 GUIDES

A. Furnish guides designed for use with expansion compensators, the product as furnished by the compensator manufacturer or a qualified pipe hanger manufacturer as approved.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install eliminators plumb in vertical piping and horizontally true in horizontal runs.

C. Do not use eliminators to compensate for misalignment between equipment and piping.

D. Install stainless steel units in ferrous piping and phosphor bronze units in non-ferrous piping.

E. Remove shipping bars from manufactured pipe loops and flexible pipe connectors prior to system start up.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Adhesive-backed duct markers.

D. Stencils.

E. Pipe markers.

F. Ceiling tacks.

1.2 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Identification painting.

1.3 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2020.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.

B. Control Panels: Nameplates.

C. Dampers: Ceiling tacks, where located above lay-in ceiling.

D. Heat Transfer Equipment: Nameplates.

E. Instrumentation: Tags.

F. Major Control Components: Nameplates.

G. Piping: Tags.

H. Pumps: Nameplates.

I. Relays: Tags.

J. Small-sized Equipment: Tags.

K. Tanks: Nameplates.

L. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.2 NAMEPLATES

A. Manufacturers:

1. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com/#sle.

2. Brimar Industries, Inc: www.pipemarker.com/#sle.

3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.

B. Letter Color: White.

C. Letter Height: 1/4 inch (6 mm).

D. Background Color: Black.

2.3 TAGS

A. Manufacturers:

1. Advanced Graphic Engraving: www.advancedgraphicengraving.com/#sle.

2. Brady Corporation: www.bradycorp.com/#sle.

3. Brimar Industries, Inc: www.pipemarker.com/#sle.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch (40 mm) diameter.

C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch (40 mm) diameter with smooth edges.

D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.4 STENCILS

A. Manufacturers:

1. Brady Corporation: www.bradycorp.com/#sle.

2. Craftmark Pipe Markers: www.craftmarkid.com/#sle.

3. Insite Solutions, LLC: www.stop-painting.com/#sle.

B. Stencils: With clean cut symbols and letters of following size:

1. 3/4 to 1-1/4 inch (20-30 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 1/2 inch (15 mm) high letters.
2. 1-1/2 to 2 inch (40-50 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 3/4 inch (20 mm) high letters.
3. 2-1/2 to 6 inch (65-150 mm) Outside Diameter of Insulation or Pipe: 12 inch (300 mm) long color field, 1-1/4 inch (30 mm) high letters.

2.5 PIPE MARKERS

A. Manufacturers:

1. Brady Corporation: www.bradycorp.com/#sle.
2. Brimar Industries, Inc: www.pipemarker.com/#sle.
3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.

B. Color: Comply with ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.

E. Color code as follows:

1. Heating, Cooling, and Boiler Feedwater: Green with white letters.
2. Toxic and Corrosive Fluids: Orange with black letters.

2.6 CEILING TACKS

A. Manufacturers:

1. Craftmark Pipe Markers: www.craftmarkid.com/#sle.

B. Description: Steel with 3/4 inch (20 mm) diameter color coded head.

C. Color code as follows:

1. HVAC Equipment: Yellow.
2. Fire Dampers and Smoke Dampers: Red.
3. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Apply stencil painting in accordance with Section 09 9123.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

F. Install underground plastic pipe markers 6 to 8 inches (150 to 200 mm) below finished grade, directly above buried pipe.

G. Use tags on piping 3/4 inch (20 mm) diameter and smaller.

1. Identify service, flow direction, and pressure.

2. Install in clear view and align with axis of piping.

3. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

H. Install ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

I. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic systems.

C. Measurement of final operating condition of HVAC systems.

D. Commissioning activities.

1.2 RELATED REQUIREMENTS

A. Section 01 9113 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

B. Section 23 0800 - Commissioning of HVAC.

1.3 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. AABC MN-1 - AABC National Standards for Total System Balance; 2002.

C. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008.

D. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; 2005, Seventh Edition.

E. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2002.

1.4 SUBMITTALS

A. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.

1. Include at least the following in the plan:

a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.

b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.

c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.

d. Final test report forms to be used.

e. Procedures for formal deficiency reports, including scope, frequency and distribution.

B. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

1. Revise TAB plan to reflect actual procedures and submit as part of final report.

2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.

3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.

4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.

5. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:

1. AABC (NSTSB), AABC National Standards for Total System Balance.

2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.

3. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.

4. SMACNA (TAB).

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. TAB Agency Qualifications:

1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.

D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.2 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.

2. Temperature control systems are installed complete and operable.

3. Proper thermal overload protection is in place for electrical equipment.

4. Final filters are clean and in place. If required, install temporary media in addition to final filters.

5. Duct systems are clean of debris.

6. Fans are rotating correctly.

7. Fire and volume dampers are in place and open.

8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.3 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.

3.4 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.5 RECORDING AND ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.6 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

H. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

3.7 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.8 COMMISSIONING

A. See Sections 01 9113 - General Commissioning Requirements and 23 0800 for additional requirements.

B. Perform prerequisites prior to starting commissioning activities.

C. Fill out Prefunctional Checklists for:

1. Air side systems.

2. Water side systems.

D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.

E. Re-check minimum outdoor air intake flows and maximum and intermediate total airflow rates for ___ percent of the air handlers plus a random sample equivalent to ____ percent of the final TAB report data as directed by Commissioning Authority.

1. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Authority.

2. Use the same test instruments as used in the original TAB work.

3. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.

4. For purposes of re-check, failure is defined as follows:

   a. Air Flow of Supply and Return: Deviation of more than 10 percent of instrument reading.

   b. Minimum Outside Air Flow: Deviation of more than 20 percent of instrument reading; for inlet vane or VFD OSA compensation system using linear proportional control, deviation of more than 30 percent at intermediate supply flow.

   c. Temperatures: Deviation of more than one degree F (0.5 degree C).

   d. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.

   e. Sound Pressures: Deviation of more than 3 decibels, with consideration for variations in background noise.

5. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.

F. In the presence of the Commissioning Authority, verify that:

1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.

2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.

3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.

3.9 MINIMUM DATA TO BE REPORTED

A. Electric Motors:

1. Manufacturer.

2. Model/Frame.

3. HP/BHP.

4. Phase, voltage, amperage; nameplate, actual, no load.

5. RPM.

6. Starter size, rating, heater elements.

7. Sheave Make/Size/Bore.

B. Pumps:

1. Identification/number.

2. Manufacturer.
3. Size/model.
4. Impeller.
5. Service.
6. Design flow rate, pressure drop, BHP.
7. Actual flow rate, pressure drop, BHP.
8. Discharge pressure.
9. Suction pressure.
10. Total operating head pressure.
11. Shut off, discharge and suction pressures.
12. Shut off, total head pressure.

C. Heat Exchangers:

1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Model number.
6. Serial number.
7. Steam pressure, design and actual.
8. Primary water entering temperature, design and actual.
9. Primary water leaving temperature, design and actual.
10. Primary water flow, design and actual.
11. Primary water pressure drop, design and actual.
12. Secondary water leaving temperature, design and actual.
13. Secondary water flow, design and actual.
14. Secondary water pressure drop, design and actual.

D. Heating Coils:

1. Identification/number.

2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Water flow, design and actual.
7. Water pressure drop, design and actual.
8. Entering water temperature, design and actual.
9. Leaving water temperature, design and actual.
10. Entering air temperature, design and actual.
11. Leaving air temperature, design and actual.
12. Air pressure drop, design and actual.

E. Air Moving Equipment:

1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow, specified and actual.
7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.
9. Total static pressure (total external), specified and actual.
10. Inlet pressure.
11. Discharge pressure.
12. Sheave Make/Size/Bore.
13. Number of Belts/Make/Size.
14. Fan RPM.

F. Return Air/Outside Air:

1. Identification/location.

2. Design air flow.
3. Actual air flow.
4. Design return air flow.
5. Actual return air flow.
6. Design outside air flow.
7. Actual outside air flow.
8. Return air temperature.
9. Outside air temperature.
10. Required mixed air temperature.
11. Actual mixed air temperature.
12. Design outside/return air ratio.
13. Actual outside/return air ratio.

G. Exhaust Fans:

1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow, specified and actual.
6. Total static pressure (total external), specified and actual.
7. Inlet pressure.
8. Discharge pressure.
9. Sheave Make/Size/Bore.
10. Number of Belts/Make/Size.
11. Fan RPM.

H. Duct Traverses:

1. System zone/branch.
2. Duct size.
3. Area.

4. Design velocity.
5. Design air flow.
6. Test velocity.
7. Test air flow.
8. Duct static pressure.
9. Air temperature.
10. Air correction factor.

I. Air Distribution Tests:

1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Design air flow.
6. Test (final) air flow.
7. Percent of design air flow.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Duct insulation.

B. Duct Liner.

C. Insulation jackets.

1.2 RELATED REQUIREMENTS

A. Section 23 0553 - Mechanical Identification.

B. Section 23 3100 - Ductwork.

1.3 REFERENCE STANDARDS

A. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2004.

B. ASTM C 553 - Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2008.

C. ASTM C 612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2009.

D. ASTM C 1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2005.

E. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.

F. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials; 2005.

G. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

1.4 SUBMITTALS

A. Product Data: Manufacturer's catalog cuts sheets, specifications, and installation instructions for the following:

1. Insulation Materials.

2. Jacket Materials.

B. Materials Schedule: Itemize insulation materials and thicknesses for each specified application in Insulation Material Schedules in Part 3 of this Section. Where optional materials are specified, indicate the option selected.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum five years of experience.

B. Regulatory Requirements:

1. Insulation installed inside buildings, including duct lining materials, laminated jackets, mastics, sealants, and adhesives shall have a Fire Spread/Smoke Developed Rating of 25/50 or less based on ASTM E 84.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of insulations, adhesives, mastics, and insulation cements.

B. Maintain temperature before, during, and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.1 FIBROUS GLASS INSULATION

A. Composed principally of fibers manufactured from rock, slag, or glass, with or without binders, and asbestos free.

B. Manufacturers:

1. Knauf Insulation.

2. Johns Manville Corporation.

3. Owens Corning Corporation.

C. Type 'A' Insulation: ASTM C 553; Flexible Blanket.

1. 'K' value: 0.31 at 75 degrees F, when tested in accordance with ASTM C 518.

2. Maximum Service Temperature: 450 degrees F.

3. Minimum Density: 1.0 pcf.

D. Type 'B' Insulation: ASTM C 612; Rigid Board.

1. 'K' value: 0.26 at 75 degrees F, when tested in accordance with ASTM C 518.

2. Maximum Service Temperature: 450 degrees F.

3. Minimum Density: 3.0 pcf or 6.0 pcf as specified.

E. Type 'C' Insulation: ASTM C 1071; Thermal and Acoustic Duct Liner Board Insulation.

1. 'K' value: 0.27 at 75 degrees F, when tested in accordance with ASTM C 518.

2. Maximum Service Temperature: 250 degrees F.

3. Minimum Density: 3.0 pcf.

4. Erosion, temperature, and fire resistant type; NFPA 90-A and 90-B.

5. Minimum Noise Reduction Coefficients:

a. 1/2 inch Thickness: 0.30.

b. 1 inch Thickness: 0.45.

c. 1-1/2 inch Thickness: 0.60.

2.2 FLEXIBLE ELASTOMERIC FOAM INSULATION

A. Manufacturers:

1. Armacell Engineered Foams.
2. Rubatex Corporation.
3. Enviro-tec Corporation.

B. Type 'D' Insulation: ASTM C 534; Sheet Insulation.

1. 'K' value: 0.27 at 75 degrees F, when tested in accordance with ASTM C 518 or C 177.
2. Maximum Water Vapor Transmission: 0.10 perm - inch based on ASTM E 96, Procedure A.
3. Fire Spread/Smoke Developed Rating: 25/50 or less based on ASTM E 84.

2.3 INSERTS

A. High Density Jacketed Insulation Inserts for Hangers and Supports:

1. For Use with Fibrous Glass Insulation: ASTM C 612 Fibrous Glass Board.
   a. 'K' value: 0.26 at 75 degrees F, when tested in accordance with ASTM C 518.
   b. Minimum Density: 6.0 pcf.

2.4 JACKETS

A. Laminated Vapor Barrier Jackets: Factory applied by insulation manufacturer, conforming to ASTM C 1136.

1. Type I: Reinforced white kraft and aluminum foil laminate with kraft facing out.
2. Type II: Reinforced aluminum foil and kraft laminate with foil facing out.
3. Laminated vapor barrier jackets are not required for flexible elastomeric foam insulation.

B. Canvas Jackets: Fire retardant cotton duck, 6 oz/sq yd, complying with NFPA 701.

C. Aluminum Jacket: ASTM B 209 formed aluminum sheet, Type 1100, 3003, 3105, or 5005, Temper H14.

1. Thickness: 0.020 inch sheet.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fastening Devices:
   a. Metal Jacket Bands: 1/2 inch wide; 0.020 inch thick Type 18-8 stainless steel.
   b. Wing Seals: Type 18-8 stainless steel, 0.032 inch thick.
   c. Sheet Metal Screws: Pan-head Type A hardened aluminum, or stainless steel.

2.5 ADHESIVES, MASTICS, AND SEALERS

A. Lagging Adhesive (Canvas Jackets): Childers' CP-50A, Epolux's Cadalag 336, Foster's 30-36.

B. Vapor Seal Adhesive (Fibrous Glass Insulation): Childers' CP-82, Epolux's Cadoprene 400, Foster's 85-75 or 85-20.

C. Vapor Barrier Mastic/Joint Sealer (Fibrous Glass Insulation): Childers' CP-30, Epolux's Cadalar 670, Foster's 95-44 or 30-35.

2.6 MISCELLANEOUS MATERIALS

A. Insulation Fasteners:

1. Manufacturers:

a. Duro-Dyne Corporation.

b. Erico Fastening Systems Inc.

c. Carlisle Hardcast Inc.

2. Fastener Type: Galvanized steel, impact applied or welded with integral head, complete with self-locking insulation retaining washers.

B. Pressure Sensitive Tape for Sealing Laminated Jackets:

1. Manufacturers:

a. Alpha Associates.

b. Childers.

c. Morgan Adhesive.

2. Tape Type: Same construction as jacket.

C. Metal Corner Angles: Galvanized steel, 2 inch x 2 inch x 28 gage.

D. Reinforcing Membrane:

1. Manufacturers:

a. Alpha Associates Style 59.

b. Childers' Chil-Glas.

c. Foster's Mast-A-Fab.

PART 3 EXECUTION

3.1 PREPARATION

A. Perform the following prior to starting insulation Work:

1. Install hangers, supports, and appurtenances in their permanent locations.

2. Complete testing of ductwork and equipment.

3. Clean and dry surfaces to be insulated.

3.2 INSTALLATION

A. General:

1. Install the Work of this Section in accordance with manufacturer's printed installation instructions unless otherwise specified.

2. All ductwork shall be thermally insulated in accordance withe the New York State Energy Conservation Code and NAIMA National Insulation Standards.

3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

4. Insulate ducts prior to erection in place when ducts are required to be installed proximate to walls, ceilings, equipment or other ductwork which will not permit adequate space for installation of insulation after ducts are installed.

B. Fibrous Glass Board Insulation Application:

1. Secure insulation to ductwork with insulation fasteners spaced 3 inches in from all corners of ducts, with intermediate fasteners at maximum 16 inch centers in all directions.

2. Butt edges of insulation and fill voids with similar insulation.

3. Seal longitudinal jacket laps continuously with vapor seal adhesive minimum 1-1/2 inch wide.

4. Lap circumferential joints with 4 inch wide jacket material and seal laps continuously with vapor barrier adhesive or 3 inch wide pressure sensitive sealing tape.

5. Install metal corner angles over the jacketed insulated corners. Seal exposed ends of insulation with vapor barrier mastic.

6. Vapor seal breaks in vapor barrier jacketing, exposed surfaces of duct insulation fasteners, and metal corner angles with pressure sensitive sealing tape or coat with vapor barrier mastic.

7. Field apply 6 oz canvas jacket over the vapor barrier jacketed insulation where indicated on Schedule of Ductwork Insulation in this Section.

a. Apply canvas jacket with lagging adhesive with a 2 inch lap on all seams.

b. Use outward clinching staples for additional securement of canvas to bottom of ducts in excess of 48 inch width.

c. Apply heavy coat of lagging adhesive to entire canvas surface.

8. Place trapeze hangers outside of jacketed insulated ducts.

a. Install high density insulation inserts, of thickness equal to insulation minimum of 4 inch width by the bottom dimension of the duct at points of support.

b. Continuously jacket insulated ducts and filler pieces through supports.

C. Fibrous Glass Blanket Insulation Application:

1. Cut insulation to stretch-out dimensions as recommended by insulation manufacturer.

2. Remove 2 inch wide strip of insulation material from the jacketing on the longitudinal and circumferential joint edges to form and overlapping flap. Install insulation with jacketing outside so flap overlaps insulation and jacketing on other end.

3. Butt ends of insulation tightly together. Do not compress insulation at duct corners on rectangular or square ductwork.

4. Staple joints with outward clinching staples minimum 6 inches on center and seal with pressure sensitive sealing tape.

5. Cut off protruding ends of fasteners flush with insulation surface and seal with pressure sensitive sealing tape.

6. Seal any tears, punctures, and penetrations of insulation jacketing with sealing tape.

7. Insulation fasteners:

   a. Install duct insulation fasteners on bottom side of horizontal duct runs when bottom dimension of the duct is in excess of 24 inches.

   b. Install duct insulation fasteners on sides of duct risers having a dimension in excess of 24 inches.

   c. Evenly space fasteners where required maximum of 16 inches on center in all directions.

D. Duct Liner Application:

1. Adhere insulation with adhesive for 90 percent coverage only where mechanical fasteners can not be used due to space or size constraints.

2. Secure insulation with mechanical liner fasteners. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible for spacing.

3. Seal and smooth joints. Seal and coat transverse joints.

4. Seal liner surface penetrations with adhesive.

5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

3.3 SCHEDULE OF DUCTWORK INSULATION

A. Exhaust Ducts Within 10 ft of Exterior Openings:

1. Type 'A' Flexible Blanket

   a. Thickness: 1-1/2 inch.

B. 100% Outside Air Ducts:

1. Concealed inside building envelope in unconditioned spaces:

   a. Type 'A' Flexible Blanket.

      1 Minimum Thickness: 2 inch.

      2 Minimum R value: R-6.

      3 Jacket Type: Type I or Type II.

   b. Type 'B' Rigid Board.

      1 Minimum Thickness: 1-1/2 inch.

      2 Minimum R value: R-6.

3 Jacket Type: Type I or Type II.

2. Exposed inside building envelope:

a. Type 'B' Rigid Board.

1 Minimum Thickness: 1-1/2 inch.

2 Minimum R value: R-6.

3 Jacket Type: Type I with Canvas Outer Jacket.

C. Air Conditioning Supply and Return; Heating Supply and Return:

1. Concealed inside building envelope in unconditioned spaces:

a. Type 'A' Flexible Blanket.

1 Minimum Thickness: 2 inch.

2 Minimum R value: R-6.

3 Jacket Type: Type I or Type II.

b. Type 'B' Rigid Board.

1 Minimum Thickness: 1-1/2 inch.

2 Minimum R value: R-6.

3 Jacket Type: Type I or Type II.

2. Exposed inside building envelope in unconditioned spaces & mechanical rooms:

a. Type 'B' Rigid Board.

1 Minimum Thickness: 1-1/2 inch.

2 Minimum R value: R-6.

3 Jacket Type: Type I with Canvas Outer Jacket.

3. Exposed inside building envelope in conditioned spaces:

a. Uninsulated unless otherwise indicated on drawings.

D. Air Conditioning Supply and Return; Heating Supply and Return:

1. Exposed exterior to building:

a. Type 'D' Elastomeric Foam Sheet.

1 Minimum Thickness: 2-1/2 inch.

2 Minimum R value: R-12.

3 Jacket Type: Aluminum Jacket.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

1.2 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

1.3 REFERENCE STANDARDS

A. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

C. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.

2.2 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:

1. Aeroflex USA, Inc: www.aeroflexusa.com.
2. Armacell LLC: www.armacell.us.
3. K-Flex USA LLC: www.kflexusa.com.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.

1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
2. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. For hot piping conveying fluids over 140 degrees F (60 degrees C), insulate flanges and unions at equipment.

C. Inserts and Shields:

1. Application: Piping 1-1/2 inches (40 mm) diameter or larger.

2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.

3. Insert location: Between support shield and piping and under the finish jacket.

4. Insert Configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.

D. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 07 8400.

E. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet (3 meters) above finished floor): Finish with canvas jacket sized for finish painting.

3.3 SCHEDULE

A. Insulate all cold service and hot service piping, equipment, and appurtenances except were otherwise specified.

B. Cooling Systems:

1. Condensate Drains from Cooling Coils:

a. Flexible Elastomeric Cellular Rubber Insulation:

1 Pipe Size Range: All sizes.

(a) Thickness: 1/2 inch.

2. Refrigerant Suction:

a. Flexible Elastomeric Insulation:

1 Up to and Including 1 inch pipe size - Insulation thickness = 1 inch.

2 1-1/4 inch and larger pipe size - Insulation thickness = 1-1/2 inch.

3. Refrigerant Hot Gas:

a. Flexible Elastomeric Insulation:

1 Up to and Including 1 inch pipe size - Insulation thickness = 1 inch.

2 1-1/4 inch and larger pipe size - Insulation thickness = 1-1/2 inch.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.2 RELATED REQUIREMENTS

A. Section 23 0553 - Identification for HVAC Piping and Equipment.

B. Section 23 2113 - Hydronic Piping.

C. Section 23 2300 - Refrigerant Piping.

1.3 REFERENCE STANDARDS

A. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2004.

B. ASTM C 533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2009.

C. ASTM C 547 - Standard Specification for Mineral Fiber Pipe Insulation; 2007.

D. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.

E. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Manufacturer's catalog cut sheets, specifications, and installation instructions for the following:

1. Insulation Materials.

2. Jacket Materials.

B. Materials Schedule: Itemize insulation materials and thicknesses for each specified application in Insulation Material Schedules in Part 3 of this Section. Where optional materials are specified, indicate the option selected.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of Work specified in this Section, with minimum five years of documented experience.

B. Regulatory Requirements:

1. Insulation installed inside buildings, including laminated jackets, mastics, sealants and adhesives shall have a Fire Spread/Smoke Developed Rating of 25/50 or less based on ASTM E 84, NFPA 255, and UL 723.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of insulations, adhesives, mastics, and insulation cements.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.1 PIPING INSULATION

A. Fibrous Glass (Mineral Fiber) Insulation: Composed principally of fibers manufactured from rock, slag, or glass, with or without binders, and asbestos free.

1. Manufacturers:

a. Johns Manville Corporation.

b. Knauf Fiber Glass.

c. Owens Corning Corporation.

2. Preformed Pipe Insulation: Minimum density 3 pcf; ASTM C 547:

a. Class 1 (Suitable for Temperatures Up to 450 degrees F): 'K' value of 0.26 at 75 degrees F.

3. Premolded Fitting Insulation: Minimum density 4.0 pcf, K of 0.26 at 75 degrees F; ASTM C 547, Class 1.

4. Insulation Inserts for PVC Fitting Jackets: Minimum density 1.5 pcf, K of 0.28 at 75 degrees F; ASTM C 553, Type III.

a. Suitable for temperatures up to 450 degrees F.

B. Flexible Elastomeric Foam Insulation:

1. Manufacturers:

a. Armacell Engineered Foams.

b. Rubatex Corporation.

c. Enviro-tec Corporation.

2. Preformed Pipe and Fitting Insulation: ASTM C 534, Type I.

3. FM tested and approved, meeting the following:

a. Maximum Water Vapor Transmission: 0.10 perm-inch based on ASTM E 96, Procedure A.

b. K of 0.27 at 75 degrees F based on ASTM C 518 or C 177.

c. Fire Spread/Smoke Developed Rating: 25/50 or less based on ASTM E 84.

4. Polyethylene and polyolefin insulation is not acceptable.

C. High Density Jacketed Insulation Inserts for Hangers and Supports:

1. Manufacturers:

a. Johns Manville Corporation.

b. Knauf Fiber Glass.

c. Owens Corning Corp.

2. For Use with Fibrous Insulation:

a. Hot Service Piping:

1 Calcium Silicate: Minimum density of 15 pcf, K of 0.50 at 300 degrees F; ASTM C 610.

2 Perlite: Minimum density 12 pcf, K of 0.60 at 300 degrees F; ASTM C 610.

D. Cements:

1. Fibrous Glass Thermal Insulating Cement: Asbestos free; ASTM C 195.

2. Fibrous Glass Hydraulic Setting Thermal Insulating and Finishing Cement: ASTM C 449/C 449M.

2.2 INSULATION JACKETS AND FITTING COVERS

A. Laminated Vapor Barrier Jackets for Piping Insulation: Factory applied by insulation manufacturer, conforming to ASTM C 1136, Type I.

1. Type I: Reinforced white kraft and aluminum foil laminate with kraft facing out.

a. Pipe Jackets: Furnished with integral 1-1/2 inch self sealing longitudinal lap, and separate 3 inch wide adhesive backed butt strips.

2. Type II: Reinforced aluminum foil and kraft laminate with foil facing out.

3. Laminated vapor barrier jackets are not required for flexible elastomeric foam insulation.

B. Premolded PVC Fitting Jackets:

1. Constructed of high impact, UV resistant PVC.

a. ASTM D 1784, Class 14253-C.

b. Working Temperature: 0-150 degrees F.

C. Metal Jacketing:

1. Aluminum Jacket: ASTM B 209 formed aluminum sheet, Type 1100, 3003, 3105, or 5005, Temper H14.

a. Factory Pre-formed Sectional Pipe Jacketing:

1 Thickness: 0.016 inch.

2 Finish: Smooth outer finish with integral bonded laminated polyethylene film - kraft paper moisture barrier underside.

3 Joining: Pittsburgh or modified Pittsburg longitudinal lock seams. 2 inch overlapping circumferential joints with integral locking clips, or butt joints sealed with 2 inch wide mastic backed aluminum snap bands.

4 Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.

b. Roll Jacketing: Smooth outer finish with integral bonded laminated polyethylene film - kraft paper moisture barrier underside.

c. Sheet Jacketing: Corrugated 1-1/4 inch x 1/4 inch deep with integral bonded laminated polyethylene film - kraft paper moisture barrier underside.

d. Fastening Devices:

1 Metal Jacket Bands: 1/2 inch wide; 0.020 inch thick Type 18-8 stainless steel.

2 Wing Seals: Type 18-8 stainless steel, 0.032 inch thick.

3 Sheet Metal Screws: Pan-head Type A hardened aluminum, or stainless steel.

2. Circumferentially Corrugated Aluminum Jacketing: Childer's Corrolon.

a. Construction: 3/16 inch circumferentially corrugated embossed aluminum, ASTM B 209, Type 1100, 3003, 3105, or 5005, Temper H14.

b. Thickness: 0.016 inch.

c. Moisture Barrier: Integrally bonded to jacket over entire surface in contact with insulation.

d. Fastening Devices:

1 Strapping: 0.020 inch thick by 1/2 inch wide, Type 3003, 3105, or 5005 aluminum. Temper H14.

2 Wing Seals: 0.032 inch thick Type 5005 aluminum. Temper H14.

2.3 ADHESIVES, MASTICS, AND SEALERS

A. Vapor Seal Adhesive (Fibrous Glass Insulation): Childers' CP-82, Epolux's Cadoprene 400, Foster's 85-75 or 85-20.

B. Vapor Barrier Mastic/Joint Sealer (Fibrous Glass Insulation): Childers' CP-30, Epolux's Cadalar 670, Foster's 95-44 or 30-35.

C. Adhesive (Flexible Elastomeric Foam): Armstrong's 520, Childers' CP-80, Epolux's Cadoprene 488, Foster's 82-40.

2.4 MISCELLANEOUS MATERIALS

A. Insulation Fasteners:

1. Acceptable Manufacturers: Duro-Dyne Corp.; Erico Fastening Systems, Inc.

2. Type: Weld pins, complete with self-locking insulation retaining washers.

B. Pressure Sensitive Tape for Sealing Laminated Jackets:

1. Acceptable Manufacturers: Alpha Associates, Childers, Ideal Tape, Morgan Adhesive.

2. Type: Same construction as jacket.

C. Wire, Bands, and Wire Mesh:

1. Binding and Lacing Wire: Nickel copper alloy or copper clad steel.
2. Bands: Galvanized steel, 1/2" wide x 0.015 inch thick, with 0.032 inch thick galvanized wing seals.
3. Wire Mesh: Woven 20 gage steel wire with 1 inch hexagonal openings, galvanized after weaving.

PART 3 EXECUTION

3.1 PREPARATION

A. Perform the following prior to starting insulation Work:

1. Install all hangers, supports, and appurtenances in their permanent locations.
2. Complete testing of piping.
3. Clean and dry all surfaces to be insulated.

3.2 INSTALLATION, GENERAL

A. Install the Work of this Section in accordance with manufacturer's printed installation instructions unless otherwise specified.

B. All piping serving as part of a heating or cooling system shall be thermally insulated in accordance withe the New York State Energy Conservation Code and NAIMA National Insulation Standards.

C. Provide continuous piping insulation and jacketing when passing thru interior wall, floor, and ceiling construction.

1. At Through Penetration Firestops: Coordinate insulation densities with the requirements of approved firestop system being installed. See Section 23 0515.

a. Insulation densities required by approved firestop system may vary with the densities specified in this Section. When this occurs use the higher density insulation.

D. Individual piping runs shall have consistent insulation type.

E. Apply Insulation to completely cover entire surface of piping. Do not insulate over weld certification stamps.

3.3 INSTALLATION AT HANGERS AND SUPPORTS

A. Reset and realign hangers and supports if they are displaced during insulation installation.

B. Install high density jacketed insulation inserts at hangers and supports for insulated piping as specified.

1. Insulation Inserts For Use with Fibrous Glass Insulation:

a. Where insulation is subject to compression at points over 180 degrees apart, e.g. riser clamps, U-bolts, or trapezes, fully encircle pipe with 2 protection shields and 2 high density jacketed fibrous glass insulation inserts within supporting members.

1 Exception: Locations where pipe covering protection saddles are specified for hot service piping, 6 inch and larger.

2. Insulation Inserts For Use with Flexible Elastomeric Foam Insulation:

a. Where clevis hangers are used, install insulation shields with hardwood filler pieces, same thickness as adjoining insulation, inserted in undersized die cut or slotted holes in insulation at support points.

b. Where hardwood blocks are used, contour to match the curvature of pipe, and shield.

c. Coat dowels and blocks with insulation adhesive, and insert while sill wet.

d. Vapor seal outer surfaces of dowels and blocks with adhesive after insertion.

e. Provide minimum 2 dowels plugs or one filler block per hanger.

3.4 INSTALLATION OF FIBROUS GLASS HOT SERVICE INSULATION

A. Install insulation materials with field or factory applied ASTM C 1136 Type I laminated vapor barrier jacket unless otherwise specified.

B. Canvas Jackets on Piping, Fittings, Valves, Flanges, Unions, and Irregular Surfaces:

1. For piping 2 inch size and smaller: 4 oz per sq yd unless otherwise specified.

2. For piping over 2 inch size: 6 oz per sq yd unless otherwise specified.

C. Piping:

1. Butt insulation joints together.

2. Continuously seal joints with minimum 1-1/2 inch wide self-sealing longitudinal jacket laps and 3-inch wide butt adhesive backed strips, or 3 inch wide pressure sensitive sealing tape of same material as jacket.

3. Fill voids in insulation at hanger with insulating cement.

4. Exceptions:

a. Piping in Accessible Shafts, Attic Spaces, Crawl Spaces, Unfinished Spaces, and Concealed Piping: Butt insulation joints together and secure with minimum 1-1/2" wide longitudinal jacket laps and 3 inch wide butt strips of same material as jacket, with outward clinching staples on maximum 4 inch centers. Fill voids in insulation at hangers with insulating cement.

b. Piping in Tunnels: Butt insulation joints together and secure with minimum 1-1/2" wide longitudinal jacket laps and 3 inch wide butt strips, of same material as jacket, with outward clinching staples on maximum 4 inch centers and 16 gage wires a minimum of 4 loops per section. Fill voids in insulation with insulating cement.

5. Fittings, Valves, Flanges and Irregular Surfaces:

a. Insulate with mitre cut or pre-molded fitting insulation of same material and thickness as adjoining pipe insulation.

b. Secure insulation in place with 16 gage wire, with ends twisted and turned down into insulation.

c. Butt fitting, valve, and flange insulation against pipe insulation and bond with insulating cement.

d. Insulate valves up to and including bonnets, without interfering with packing nuts.

e. Apply leveling coat of insulating cement to smooth out insulation and cover wiring.

f. When insulating cement has dried, coat insulated surface with lagging adhesive, and apply 4 oz. or 6 oz. canvas jacket as required by pipe size.

1 Lap canvas jacket on itself and adjoining pipe insulation at least 2 inches.

2 Size entire canvas jacket with lagging adhesive.

g. Exceptions:

1 Insulate fittings, valves, and irregular surfaces 3 inch size and smaller with insulating cement covered with 4 oz or 6 oz canvas jacket as required by pipe size. Terminate pipe insulation adjacent to flanges and unions with insulating cement, troweled down to pipe on a bevel.

2 Sizing of canvas surface is not required on fittings, valves, flanges, and irregular surfaces in concealed piping, piping in accessible shafts, attic spaces, crawl spaces, unfinished spaces, and tunnels.

6. Fittings, Valves, Flanges and Irregular Surfaces - Alternate:

a. Apply one piece pre-molded PVC fitting covers with fibrous glass insulation inserts with galvanized coated tack fasteners. Tape circumferential joint between insulation and premolded fitting cover with 2 inch wide pressure sensitive polyvinyl tape.

1 Exception: Provide additional insulation inserts on service operating at over 250 degrees F or where insulation thickness exceeds 1-1/2 inches. Ensure that insulation is adequate to prevent PVC fitting jacket temperature from exceeding 150 degrees F.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC FOAM INSULATION

A. Slit insulation and install over pipe. Seal longitudinal and butt joints with adhesive.

B. Insulate fittings and valves with miter cut sections. Use templates provided by the manufacturer and assemble the cut sections in accordance with the manufacturer's printed instructions.

1. Insulate threaded fittings and valves with sleeved fitting covers. Over lap and seal the covers to the adjoining pipe insulation with adhesive.

C. Carefully mate and seal with adhesive all contact surfaces to maintain the integrity of the vapor barrier system.

D. Insulated Covers for Pumps:

1. Do not extend pump insulation beyond or interfere with stuffing boxes, or interfere with adjustment and servicing of parts requiring regular maintenance or operating attention.

E. Piping Exposed to the Elements:

1. Apply flexible elastomeric foam insulation to piping with adhesive.

2. Apply reinforcing membrane around piping insulation with adhesive or mastic.

3. Adhesive Applied System: Apply another coat of mastic over reinforcing membrane.

4. Mastic Applied System: Apply another coat of mastic over reinforcing membrane.

3.6 INSTALLATION OF METAL JACKETING ON PIPING

A. Secure jacketing to insulated piping with preformed aluminum snap straps and stainless steel strapping installed with special banding wrench.

B. Jacket exposed insulated fittings, valves and flanges with mitered sections of aluminum jacketing.

1. Seal joints with sealant and secure with preformed aluminum bands.

2. Alternate:

a. Factory fabricated, preformed, sectional aluminum fitting covers may be used in lieu of mitered sections of aluminum jacketing for covering fittings, valves and flanges.

3.7 SCHEDULE OF PIPING AND EQUIPMENT INSULATION

A. Insulate all cold service and hot service piping, equipment, and appurtenances except were otherwise specified.

B. Hot Service Piping Insulation Schedule:

1. Heating Water/Glycol Supply and Return:

a. Fibrous Glass Insulation:

1 Up to 1-1/2 inch pipe size - Insulation thickness = 1-1/2 inch

2 1-1/2 inch pipe size and larger - Insulation thickness = 2 inch

C. Do not insulate the following hot service items:

1. Piping inside convector, cabinet heater, and fin tube radiation enclosures.

2. Drains from heating equipment and appurtenances that flow to waste.

3. Water and other fluids 81 degrees F to 104 degrees F.

4. Boiler blow-off and blow-down piping.

5. Vent piping to atmosphere.

6. Flanges and unions.

7. Hydronic specialties: flow indicators, zone control valves, air vents, and air control fittings.

8. Pressure reducing valves and pilot lines.

9. Actual heat transfer surfaces.

10. Hot water pumps.

D. Do not insulate any equipment with a factory applied insulated steel jacket.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. See Section 01 9113 - General Commissioning Requirements for overall objectives; comply with the requirements of Section 01 9113.

B. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

C. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.

D. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:

1. Control system.
2. Major and minor equipment items.
3. Piping systems and equipment.
4. Ductwork and accessories.
5. Terminal units.
6. Variable frequency drives.
7. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

E. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.2 RELATED REQUIREMENTS

A. Section 01 9113 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

B. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.

C. Section 23 0900 - Building Automation System.

1.3 REFERENCE STANDARDS

A. ASHRAE Guideline 1.1 - HVAC&R Technical Requirements for the Commissioning Process; 2007, with Errata (2012).

1.4 SUBMITTALS

A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. Draft Prefunctional Checklists and Functional Test Procedures for Control System: Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing; include at least the following for each type of equipment controlled:

1. System name.
2. List of devices.
3. Step-by-step procedures for testing each controller after installation, including:
    a. Process of verifying proper hardware and wiring installation.
    b. Process of downloading programs to local controllers and verifying that they are addressed correctly.
    c. Process of performing operational checks of each controlled component.
    d. Plan and process for calibrating valve and damper actuators and all sensors.
    e. Description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.
4. Copy of proposed log and field checkout sheets to be used to document the process; include space for initial and final read values during calibration of each point and space to specifically indicate when a sensor or controller has “passed” and is operating within the contract parameters.
5. Description of the instrumentation required for testing.
6. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the Commissioning Authority and TAB contractor for this determination.

C. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.

D. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:

1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
2. Full as-built set of control drawings.
3. Full as-built sequence of operations for each piece of equipment.
4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
    a. Floor.
    b. Room number.
    c. Room name.
    d. Air handler unit ID.
    e. Reference drawing number.
    f. Air terminal unit tag ID.

g. Heating and/or cooling valve tag ID.

h. Minimum air flow rate.

i. Maximum air flow rate.

5. Full print out of all schedules and set points after testing and acceptance of the system.

6. Full as-built print out of software program.

7. Electronic copy on disk of the entire program for this facility.

8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.

9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.

10. Control equipment component submittals, parts lists, etc.

11. Warranty requirements.

12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).

13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:

a. Sequences of operation.

b. Control drawings.

c. Points lists.

d. Controller and/or module data.

e. Thermostats and timers.

f. Sensors and DP switches.

g. Valves and valve actuators.

h. Dampers and damper actuators.

i. Program setups (software program printouts).

E. Project Record Documents: See Section 01 7800 for additional requirements.

1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.

2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.

F. Draft Training Plan: In addition to requirements specified in Section 01 7900, include:

1. Follow the recommendations of ASHRAE Guideline 1.1.

2. Control system manufacturer's recommended training.

3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.

G. Training Manuals: See Section 01 7900 for additional requirements.

1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

PART 3 EXECUTION

3.1 PREPARATION

A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.

B. Furnish additional information requested by the Commissioning Authority.

C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.

D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.

E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.

F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.

G. Provide temperature and pressure taps in accordance with Contract Documents.

3.2 INSPECTING AND TESTING - GENERAL

A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.

B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.

C. Provide two-way radios for use during the testing.

D. Valve/Damper Stroke Setup and Check:

1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.

2. Set pump/fan to normal operating mode.

3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
4. Command valve/damper open; verify position is full open and adjust output signal as required.
5. Command valve/damper to a few intermediate positions.
6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).
7. Closure for Heating Coil Valves - Normally Open:
    a. Set heating setpoint 20 degrees F (11 degrees C) above room temperature.
    b. Observe valve open.
    c. Remove control air or power from the valve and verify that the valve stem and actuator position do not change.
    d. Restore to normal.
    e. Set heating setpoint to 20 degrees F (11 degrees C) below room temperature.
    f. Observe the valve close.
    g. Restore to normal.

E. Isolation Valve or System Valve Leak Check: For valves not by coils.
1. With full pressure in the system, command valve closed.
2. Use an ultra-sonic flow meter to detect flow or leakage.

F. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.3 TAB COORDINATION

A. TAB: Testing, adjusting, and balancing of HVAC.

B. Coordinate commissioning schedule with TAB schedule.

C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.

D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.

E. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.

F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.4 CONTROL SYSTEM FUNCTIONAL TESTING

A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with Contract Documents.

C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.

D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.

1. The scope of trend logging is partially specified; trend log up to 50 percent more points than specified at no extra cost to Owner.

2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.

E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

F. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.

1. Setpoint changing features and functions.

2. Sensor calibrations.

G. Demonstrate to the Commissioning Authority:

1. That all specified functions and features are set up, debugged and fully operable.

2. That scheduling features are fully functional and setup, including holidays.

3. That all graphic screens and value readouts are completed.

4. Correct date and time setting in central computer.

5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to Owner.

6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to Owner.

7. Power failure and battery backup and power-up restart functions.

8. Global commands features.

9. Security and access codes.

10. Occupant over-rides (manual, telephone, key, keypad, etc.).

11. O&M schedules and alarms.

12. Occupancy sensors and controls.

13. All control strategies and sequences not tested during controlled equipment testing.

H. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

3.5 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 7800 for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.6 DEMONSTRATION AND TRAINING

A. See Section 01 7900 for additional requirements.

B. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

C. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.

D. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned.

E. TAB Review: Instruct Owner's personnel for minimum 2 hours, after completion of TAB, on the following:

1. Review final TAB report, explaining the layout and meanings of each data type.

2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.

3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.

4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.

5. Other salient information that may be useful for facility operations, relative to TAB.

F. HVAC Control System Training: Perform training in at least three phases:

1. Phase 1 - Basic Control System: Provide minimum of 4 hours of actual training on the control system itself. Upon completion of training, each attendee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.

   a. This training may be held on-site or at the manufacturer's facility.

   b. If held off-site, the training may occur prior to final completion of the system installation.

   c. For off-site training, Contractor shall pay expenses of up to two attendees.

2. Phase 2 - Integrating with HVAC Systems: Provide minimum of 4 hours of on-site, hands-on training after completion of Functional Testing. Include instruction on:

   a. The specific hardware configuration of installed systems in this facility and specific instruction for operating the installed system, including interfaces with other systems, if any.

b. Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.

c. Trend logging and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends; provide practice in setting up trend logging and monitoring during training session.

d. Every display screen, allowing time for questions.

e. Point database entry and modifications.

G. Provide the services of manufacturer representatives to assist instructors where necessary.

H. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes control equipment and installation for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-furnished controls.

B. The control system shall be extension of the existing Honeywell Controls System and all controllers and software shall match existing or be the latest version of existing.

C. Deruyter Central School District's existing Building Management System is Honeywell. The project is designed and based upon the extension of this system.

D. All control systems in each building shall seamlessly integrate with the existing system without the use of integrator panels, routers, or any other hardware or software. The control system manufacturer shall guarantee that all new controls operate with the existing Siemens Apogee systems.

E. All temperature control equipment for the project will be purchased by the district via OGS New York State Contract and turned over to the HVAC Contractor for installation. The HVAC Contractor shall be responsible to provide the service to develop the Direct Digital Temperature Controls System documentation (submittals and as-built drawings), programming, installation of the equipment, and commissioning such that the project has a complete and workable Direct Digital Temperature Controls System compliant with the requirements of specification section 230900.

1.2 WORK INCLUDED

A. The BAS Contractor shall provide a complete and operational system that will perform the sequences of operation as described herein.

B. Furnish a complete distributed direct digital control system in accordance with this specification section. This includes all system controllers, logic controllers, and all input/output devices. Items of work included are as follows:

1. Provide a submittal that meets the requirements below for approval.

2. Coordinate installation schedule with the mechanical contractor and general contractor.

3. Provide installation of all panels and devices unless otherwise stated.

4. Provide power for panels and control devices unless otherwise stated.

5. Provide all low voltage control wiring for the DDC system.

6. Provide engineering and technician labor to program and commission software for each system and operator interface. Submit commissioning reports for approval.

7. Provide testing, demonstration and training as specified below.

C. The installation of the control system shall be performed under the direct supervision of the controls manufacturer with the shop drawings, flow diagrams, bill of materials, component designation, or identification number and sequence of operation all bearing the name of the manufacturer.

1.3 SUBMITTALS

A. Provide submittals for fast track items that need to be approved and released to meet the schedule of the project. Provide submittals for the following items separately upon request:

1. Valve schedule and product data
2. Damper schedule and product data
3. Mounting and wiring diagrams for factory-installed control components
4. Thermostat locations

B. Provide a complete submittal with all controls system information for approval before construction starts. Include the following:

1. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
2. Wiring Diagrams: Power, signal, and control wiring. Detail the wiring of the control devices and the panels. Show point-to-point wiring from field devices to the control panel. Show point-to-point wiring of hardwired interlocks. Show a ladder diagram or schematic of wiring internal to the panels, including numbered terminals. Clearly designate wiring that is done at a factory, at a panel shop or in the field.
3. Details of control panel faces, including sizes, controls, instruments, and labeling.
4. Schedule of dampers and actuators including size, leakage, and flow characteristics. If dampers are furnished by other, submit a damper actuator schedule coordinating actuator sizes with the damper schedule.
5. Schedule of valves including leakage and flow characteristics.
6. Written description of the Sequence of Operations.
7. Network riser diagram showing wiring types, network protocols, locations of floor penetrations and number of control panels. Label control panels with network addresses and BACnet device instance numbers. Show all routers, switches, hubs and repeaters.
8. Point list for each system controller including both inputs and outputs (I/O), point numbers, controlled device associated with each I/O point, and location of I/O device.
9. Starter and variable frequency drive wiring details of all automatically controlled motors.
10. Product Data: Include manufacturer's technical literature for each control device indicated, labeled with setting or adjustable range of control. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated. Submit a write-up of the application software that will be used on the operator workstation including revision level, functionality and software applications required to meet the specifications.
11. Submit BACnet Protocol Implementation Conformance Statements (PICS) for all direct digital controllers, software and other system components that will communicate on the BAS utilizing BACnet.

C. Submit blank field check-out and commissioning test reports, customized for each panel or system, which will be filled out by the technician during start-up.

D. Variance letter: Submit a letter detailing each item in the submission that varies from the contract specification or sequence of operation in any way.

E. After the BAS system is approved for construction, submit sample operator workstation graphics for typical systems for approval. Print and submit the graphics that the operator will use to view the systems, change setpoints, modify parameters and issue manual commands. Programming shall not commence until typical graphics are approved.

F. Operation and Maintenance Data: In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Product data with installation details, maintenance instructions and lists of spare parts for each type of control device.

2. Keyboard illustrations and step-by-step procedures indexed for each operator function.

3. Inspection period, cleaning methods, cleaning materials recommended and calibration tolerances.

4. Calibration records and list of set points.

1.4 PROJECT RECORD DOCUMENTS

A. Project Record Documents:

1. Project Record Drawings. As-built versions of the submittal shop drawings provided as AutoCAD compatible files in electronic format.

2. Operation and Maintenance (O & M) Manual.

a. As-built versions of the submittal product data.

b. Names, addresses, and 24-hour telephone numbers of installing contractors and service representatives for equipment and control systems.

c. Operator's Manual with procedures for operating control systems, logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing setpoints and variables.

d. Programming manual or set of manuals with description of programming language and of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.

e. Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.

f. Documentation of all programs created using custom programming language, including setpoints, tuning parameters, and object database.

g. Graphic files, programs, and database on electronic media.

h. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware, including computer equipment and sensors.

i. Complete original original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.

j. Licenses, guarantees, and warranty documents for equipment and systems.

B. Provide maintenance manual to serve as training and reference manual for all aspects of day-to-day maintenance and major system repairs. As a minimum include the following:

1. Complete as-built installation drawings for each building system.

2. Overall system electrical power supply schematic indicating source of electrical power for each system component. Indicate all battery backup provisions.

3. Drawings showing installation details and locations of equipment.

4. Parts list with manufacturer's catalog numbers.

1.5 QUALITY ASSURANCE

A. Codes

1. Perform all wiring in accordance with Division 26, NEC, local codes and Owner's requirements.

B. Qualifications

1. Installing contractor shall be in the business of installing and servicing DDC controls for mechanical systems, temperature and ventilation control, environmental controls as their primary business.

2. Installer Qualifications: An experienced installer who is the authorized representative of the automatic control system manufacturer for both installation and maintenance of controls required for this Project.

3. Engineering, drafting, programming, and graphics generation shall be performed by the local branch engineers and technicians directly employed by the Building Automation System Contractor.

4. Supervision, checkout and commissioning of the system shall be by the local branch engineers and technicians directly employed by the Building Automation System Contractor. They shall perform commissioning and complete testing of the BAS system.

C. All portions of the system must be designed, furnished, installed, commissioned and serviced by manufacturer approved, factory trained employees.

D. The system shall have a documented history of compatibility by design for a minimum of 15 years. Future compatibility shall be supported for no less than 10 years. Compatibility shall be defined as the ability for any existing control system component including but not limited to building controllers, advanced application controllers, application specific, personal operator workstations and portable operator's terminals, to be connected and directly communicate with any new BAS system equipment without bridges, routers or protocol converters.

1.6 COORDINATION

A. Coordinate IP drops, network connections, user interfaces, firewall, etc with Owner's IT representative.

B. Coordinate location of thermostats, humidistats, panels, and other exposed control components with plans and room details before installation.

C. Coordinate equipment with Division 28 "Fire Alarm" to achieve compatibility with equipment that interfaces with that system.

D. Coordinate power for control units and operator workstation with electrical contractor.

E. Coordinate equipment with provider of starters and drives to achieve compatibility with motor starter control coils and VFD control wiring.

F. Coordinate scheduling with the mechanical contractor and general contractor. Submit a schedule for approval based upon the installation schedule of the mechanical equipment.

G. Coordinate installation of taps, valves, airflow stations, etc. with the mechanical contractor.

H. Products Furnished but Not Installed Under This Section

1. Hydronic and Refrigerant Piping accessories:
    a. Control Valves
    b. Temperature Sensor Wells and Sockets
    c. Pressure Sensor Wells and Sockets
    d. Flow Switches
    e. Flow Meters
    f. Differential Pressure Transmitters
    g. Sheet metal accessories
        1 Dampers
        2 Airflow Stations
        3 Terminal Unit Controls

I. Products Installed but Not Furnished Under This Section

1. Refrigeration Equipment:
    a. Refrigerant Leak Detection System
    b. Proof of flow pressure switches
    c. Rooftop Air Handling Equipment:
        1 Thermostats
        2 Duct Static Pressure Sensors

J. Products Integrated To but Not Furnished or Installed Under This Section

1.7 WARRANTY

A. Provide warranty per Division 20 Section “General Mechanical Requirements” and as supplemented in this section.

B. Warranty shall cover all costs for parts, labor, associated travel, and expenses for a period of 12 months from completion of system demonstration.

C. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the vendor. The maximum acceptable response time to provide this service at the site shall be 24 hours.

D. During normal building occupied hours, failure of items that are critical for system operation shall be provided within 4 hours of notification from the Owner’s Representative.

E. This warranty shall apply equally to both hardware and software.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

A. The Building Automation System (BAS) contractor shall furnish and install a networked system of HVAC controls. The contractor shall incorporate direct digital control (DDC) for central plant equipment, building ventilation equipment, supplemental heating and cooling equipment, and terminal units.

B. The control system for this project shall be an extension of the Owner's existing Siemens Building Automation System and all controllers and software shall match existing or be latest version of existing.

C. Provide networking to new DDC equipment using industry accepted communication standards. System shall utilize BACnet communication according to ANSI/ASHRAE standard 135-2010 for interoperability with smart equipment, for the main IP communication trunk to the BAS Server and for peer-to-peer communication between DDC panels and devices. The system shall not be limited to only standard protocols, but shall also be able to integrate to a wide variety of third-party devices and applications via drivers and gateways.

D. Provide standalone controls where called for on the drawings or sequences.

E. The BAS shall be the Siemens Desigo CC system as manufactured by Siemens Building Technologies.

2.2 BUILDING AUTOMATION SYSTEM NETWORK

A. The Building Level Controllers shall be able to support subnetwork protocols that may be needed depending on the type of equipment or application. Subnetworks shall be limited to :

1. BACnet MS/TP
2. Apogee FLN

B. BACnet MSTP Setup rules

1. Addressing for the MSTP devices shall start at 00 and continue sequentially for the number of devices on the subnetwork.
2. No gaps shall be allowed in the addresses.
3. Set the MaxMaster property to the highest address of the connected device.
4. MaxMaster property shall be adjusted when devices are added to the subnetwork.

C. Provide all communication media, connectors, repeaters, bridges, switches, and routers necessary for the internetwork.

D. Controllers and software shall be BTL listed at the time of installation.

E. The system shall meet peer-to-peer communication services such that the values in any one BACnet Building Controller or BACnet Advanced Application Controller can be read or changed from all other controllers without the need for intermediary devices. The software shall provide transparent transfer of all data, control programs, schedules, trends, and alarms from any one controller through the internetwork to any other controller, regardless of subnetwork routers.

F. Systems that use variations of BACnet using Point-to-Point (PTP) between controllers, gateways, bridges or networks that are not peer-to-peer are not allowed.

G. Remote Communications: Provide a TCP/IP compatible communication port for connection to the Owner's network for remote communications. Provide coordination with the Owner for addressing and router configuration on both ends of the remote network.

H. The system shall be installed with a 10% spare capacity on each subnetwork for the addition of future controllers.

2.3 BUILDING AUTOMATION SYSTEM SERVER HARDWARE

A. BAS Server application and database are existing.

2.4 BACNET BUILDING CONTROLLERS

A. Provide all necessary hardware for a complete operating system as required. The Building Controller shall be able to operate as a standalone panel and shall not be dependent upon any higher level computer or another controller for operation.

1. The Building Level Controller shall support transmitting and receiving segmented messages.

2. The Building Level Controller shall have the capability to be the BACnet/IP Broadcast Management Device (BBMD) and support foreign devices.

3. The Building Level Controller shall have the capability to act as a BACnet router between MS/TP subnetworks and BACnet/IP.

B. This level of controller shall be used for the following types of systems:

1. Chiller plant systems

2. Heating plant systems

3. Cooling Towers

4. Pumping systems

5. VAV air handlers

6. Air handlers over 15,000 cfm

7. Systems with over 24 input/output points

8. Rooftop systems

C. Computing power and memory minimum:

1. A 32-bit, stand-alone, multi-tasking, multi-user, real-time 100MHz digital control microprocessor module.

2. Inputs shall be 16-bit minimum analog-to-digital resolution

3. Outputs shall be 10-bit minimum digital-to-analog resolution

4. Memory module (24 Megabyte, minimum) to accommodate all Primary Control Panel software requirements, including but not limited to, its own operating system and databases (see Controllers Software section), including control processes, energy management applications, alarm management applications, historical/trend data for points specified, maintenance support applications, custom processes, operator I/O, dial-up communications.

5. Real time clock and battery

6. Data collection/ Data Trend module sized for 10,000 data samples.

7. Flash Memory Firmware: Each Building Level Control Panel shall support firmware upgrades without the need to replace hardware.

D. Onboard or Modular hardware and connections:

1. Primary Network communication module, if needed for primary network communications.
2. Secondary Network communication module, if needed for secondary network communications.
3. RJ45 port 10/100Mbaud
4. RS485 ports for subnetworks and point expansion
5. Man to Machine Interface port (MMI)
6. USB Port

E. Input and Output Points Hardware

1. Input/output point modules as required including spare capacity.
2. Input/output point modules shall have removable terminal blocks.
3. Monitoring of the status of all hand-off-auto switches.
4. Monitoring of all industry standard types of analog and digital inputs and outputs, without the addition of equipment to the primary control panel.
5. Local status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Each primary control panel shall perform diagnostics on all inputs and outputs and a failure of any input or output shall be indicated both locally and at the operator workstation.
6. Graduated intensity LEDs or analog indication of value for each analog output.

F. Code compliance

1. Approvals and standards: UL916; CE; FCC
2. Provide UL864-UUKL where called for in the sequences of operations.

G. Accessories:

1. Appropriate NEMA rated metal enclosure.
2. Power supplies as required for all associated modules, sensors, actuators, etc.

H. Each Building Level Control Panel shall continuously perform self-diagnostics on all hardware modules and network communications. The System Level Control Panel shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication with any system.

I. Panel setup, point definitions and sequencing diagrams shall be backed up on EEPROM memory.

J. Power loss. In the event of the loss of power, there shall be an orderly shutdown of all Building Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 30 days.

K. Building Level control panels shall provide at least two serial data communication ports for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals. Primary control panels shall allow temporary use of portable devices without interrupting the normal communications, operation of permanently connected modems, printers or terminals.

L. Building Level Controllers shall have the capability to serve as a gateway between Modus subnetworks and BACnet objects. Provide software, drives and programming.

M. Spare Capacity: Provide enough inputs and outputs to handle the equipment shown to be “future” on drawings and 10% more of each point type. Provide all hardware modules, software modules, processors, power supplies, communication controllers, etc. required to ensure adding a point to the spare point location only requires the addition of the appropriate sensor/actuator and field wiring/tubing.

N. Environment.

1. Controller hardware shall be suitable for the anticipated ambient conditions.

2. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at 0°C to 49°C (32°F to 120°F).

3. Controllers used in conditioned space shall be mounted in dust-proof enclosures and shall be rated for operation at 0°C to 49°C (32°F to 120°F).

4. Controller hardware shall be optionally suitable for rooftop environments.

2.5 BACNET ADVANCED APPLICATION CONTROLLERS (DXR)

A. Each Advanced Application Controller shall operate as a stand-alone controller capable of performing its user selectable control routines independently of any other controller in the system. Each Advanced Application Controller shall provide standard applications and programmability to provide both reliability and flexibility. Each advanced application controller shall be a microprocessor-based, multi-tasking, digital control processor.

B. Basis of design is the programmable Siemens DXR controller.

C. Configurable control applications. Each Advanced Application Controller model must have a set of pre-loaded, selectable and field-adjustable control applications appropriate for the secondary HVAC equipment that the controller model is intended to control. Specific applications must be configurable to meet the user's control strategy requirements, allowing for additional system flexibility.

D. Programmability: Advanced Application Controllers shall be programmable. Program language shall be graphical.

E. The Advanced Application Controller shall include all point inputs and outputs necessary to perform the specified HVAC control sequences. The controller shall accept input and provide output signals that comply with industry standards. Controllers only utilizing proprietary control output signals shall not be acceptable. Controllers shall provide outputs utilized either for two-state, modulating floating, or proportional control, allowing for additional system flexibility.

1. Analog inputs shall be software configurable to accept sensors using 0-10v (such as RH or CO2 sensors), NTC3k, NTC10k, NTC100k, Ni1000, PT1K 385, PT1K 375, and resistance sensors of 1000O, 2500 O, 10K O, and 100k O. 24vDC or 24vAC power to drive active sensors shall be an option available from the controller.

2. Differential Pressure sensor (on selected controllers) 0-500 Pa (0-2.0 in. w.c.)

3. Digital input

4. Analog Outputs shall support 0-10v HVAC control signals.

5. Digital outputs shall be AC 24V high-side switching triacs, able to switch loads of 250 mA / 6 VA per output.

6. Every installed Advanced Application Controller shall be prepared for the addition of occupancy, CO2 and humidity sensors

7. Additional sensors and output modules for occupancy, lighting and shade control within the same space as the HVAC control shall be connected as needed via a sub-network connection on each Advanced Application Controller

8. The Advanced Application Controller shall be compatible with a Siemens Room Unit which combines a display with CO2, temperature and humidity sensing in 1 wall device.

9. The Advanced Application Controller shall be compatible with a Siemens Room Unit which combines a display with temperature sensing and configurable switches for lighting, shade and scene control in 1 wall device.

F. Advanced Application Controller communication

1. Communication over floor level network shall be BACnet over MS/TP or BACnet IP over Ethernet.

2. A maximum of 96 controllers may be configured on individual BACnet MS/TP networks.

3. Each controller that uses BACnet IP shall provide at least two Ethernet ports allowing the controllers to be wired in a daisy-chain configuration of up to at least 20 controllers per chain, utilizing standard Ethernet cables of up to 300ft in length between each controller.

G. The Advanced Application Controller shall have the BTL listing and meet the BACnet device profile of an Advanced Application Controller (B-AAC) as specified in ANSI/ASHRAE 135-2012.

H. Each Advanced Application Controller shall, at a minimum, be provided with:

1. Appropriate NEMA rated enclosure

2. Power supplies as required for all associated modules, sensors, actuators, etc.

3. Each controller measuring air volume shall include a differential pressure transducer

4. Approvals and standards: UL916 PAZX; UL864 UUKL; CUL; FCC

5. Plenum rated per UL94-5VB flammability rating, UL1995

I. Each Advanced Application Controller shall continuously perform self-diagnostics on all hardware and secondary network communications. The Advanced Application Controller shall provide both local and remote annunciation of any detected component failures or repeated failure to establish communication to the system.

J. Power Supply. The Advanced Application controller shall be powered from a 24 VAC, 50/60 Hz source and shall function normally under an operating range of -15% / +20%.

K. All controller configuration settings and programs shall be stored in non-volatile memory. The controllers shall be able to return to full normal operation without user intervention after a power failure of unlimited duration.

L. Environment. The controllers shall function normally under ambient conditions of 23 to 122°F (-5 to 50°C) and 5% to 95% RH (non-condensing). Provide each controller with a suitable cover or enclosure to protect the circuit board assembly.

2.6 CONTROL PANELS

A. Controllers in mechanical rooms shall be mounted in NEMA 1 enclosures.

B. Controllers in areas where moisture is a concern shall be mounted in NEMA 12 enclosures.

C. Controllers installed outdoors shall be mounted in NEMA 4X enclosures. Provide heaters where freezing temperatures are normally experienced.

D. Mount on walls at an approved location or provide a free standing rack.

E. Panels shall be constructed of 16 gauge, furniture-quality steel, or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with ANSI 61 gray polyester-powder painted finish, UL listed. Provide common keying for all panels.

F. Provide power supplies for control voltage power.

G. Dedicate 1 power supply to the DDC controller. Other devices shall be on a separate power supply, unless the power for the control device is derived from the controller terminations.

H. Power supplies for controllers shall be a transformer with a fuse or circuit breaker. Power supplies for other devices can be plain transformers.

I. All power supplies for 24V low voltage wiring shall be class 2 rated and less than 100VA. If low voltage devices require more amps, then provide multiple power supplies. If a single device requires more amps, then provide a dedicated power supply in a separate enclosure and run a separate, non-class 2 conduit to the device.

J. Surge transient protection shall be incorporated in design of system to protect electrical components in all DDC Controllers and operator's workstations.

K. All devices in a panel shall be permanently mounted, including network switches, modems, media converters, etc.

L. Provide a pocket to hold documentation.

2.7 SENSORS

A. General

1. Provide mounting hardware for all devices, including actuator linkages, wells, installation kits for insertion devices, wall boxes and fudge plates, brackets, etc.

2. If a special tool is required to mount a device, provide that tool.

B. Terminal Unit Space Thermostats

1. Each controller performing space temperature control shall be provided with a matching room temperature sensor.

a. Plain Space Temperature Sensors – Wired: Where called for in the sequences or on the drawings, provide sensors with plain covers.

b. The sensing element for the space temperature sensor shall be thermistor type providing the following.

1	Element Accuracy:	+ /- 1.0°F
2	Operating Range:	55 to 95°F
3	Set Point Adjustment Range:	55 to 95°F
4	Calibration Adjustments:	None required
5	Installation:	Up to 100 ft. from controller
6	Auxiliary Communications Port:	as required
7	Local LCD Temperature Display:	as required
8	Setpoint Adjustment Dial	as required
9	Occupancy Override Switch	as required

10 Auxiliary Communication Port. Each room temperature sensor shall include a terminal jack integral to the sensor assembly. The terminal jack shall be used to connect a portable operator's terminal to control and monitor all hardware and software points associated with the controller. RS-232 communications port shall allow the operator to query and modify operating parameters of the local room terminal unit from the portable operator's terminal.

c. Digital Display temperature sensor specifications – Wired:

1 As called for in the sequences of operations or on the drawings, provide temperature sensors with digital displays.

2 The sensing element for the space temperature sensor must be IC-based and provide the following.

(a) Digitally communicating with the Application Specific Controller.

(b) Mountable to and fully covering a 2 x 4 electrical junction box without the need for an adapter wall plate.

(c) IC Element Accuracy: +/- 0.9°F

(d) Operating Range: 55 to 95°F

(e) Setpoint Adjustment Range: User limiting, selectable range between 55 and 95°F

(f) Display of temperature setpoint with numerical temperature values

(g) Display of temperature setpoint graphically, with a visual Hotter/Colder setpoint indication

(h) Calibration: Single point, field adjustable at the space sensor to +/- 5°F

(i) Installation: Up to 100 ft. from controller

(j) Auxiliary Communications Port: included

(k) Local OLED Temperature Display: included

(l) Display of Temperature to one decimal place

(m) Temperature Setpoint Adjustment included

(n) Occupancy Override Function included

3 Auxiliary Communication Port. Each room temperature sensor shall include a terminal jack integral to the sensor assembly. The terminal jack shall be used to connect a portable operator's terminal to control and monitor all hardware and software points associated with the controller. RS-232 communications port shall allow the operator to query and modify operating parameters of the local room terminal unit from the portable operator's terminal.

d. Provide the following options as they are called for in the sequences or on the drawings:

1 Setpoint Adjustment. The setpoint adjustment function shall allow for modification of the temperature by the building operators. Setpoint adjustment may be locked out, overridden, or limited as to time or temperature through software by an authorized operator at any central workstation, Building Controller, room sensor two-line display, or via the portable operator's terminal.

2 Override Switch. An override button shall initiate override of the night setback mode to normal (day) operation when activated by the occupant and enabled by building operators. The override shall be limited to

two (2) hours (adjustable.) The override function may be locked out, overridden, or limited through software by an authorized operator at the operator interface, Building Controller, room sensor two-line display or via the portable operator's terminal.

3 Space Combination Temperature and Humidity Sensors. Each controller performing space temperature control shall be provided with a matching room temperature sensor, which also includes the ability to measure humidity for either monitoring or control purposes. The combination temperature and humidity sensors shall have the same appearance as the space temperature sensors. Humidity elements shall measure relative humidity with a +/- 2% accuracy over the range of 10 to 90% relative humidity. Humidity element shall be an IC (integrated circuit) sensing element. Humidity sensing elements shall be removable and field replaceable if needed.

C. Temperature Sensors

1. All temperature sensors shall meet the following specifications:

a. Accuracy: Plus or minus 0.2 percent at calibration point.

b. Wire: Twisted, shielded-pair cable.

c. Vibration and corrosion resistant

d. Space temperature sensors shall meet the following specifications:

1 10k ohm type 2 thermistors

e. Insertion Elements in Ducts shall meet the following specifications:

1 Single point 10k ohm thermistor

2 Use where not affected by temperature stratification

3 The sensor shall reach more that 1/3 the distance from the duct wall

4 Junction box for wire splices

f. Averaging Elements in Ducts shall meet the following specifications:

1 72 inches (183 cm) long

2 Flexible

3 Use where prone to temperature stratification, in front of coils, or where ducts are larger than 9 sq. ft.

4 Junction box for wire splices

g. Insertion Elements for Liquids shall meet the following specifications:

1 Platinum RTD with 4-20mA transmitter

2 Threaded mounting with matching well

3 Brass well with minimum insertion length of 2-1/2 inches for pipes up to 4” diameter

4 Brass well with insertion length of 6 inches for pipes up to 10” diameter

5 Junction box for wire splices

h. Outside-Air Sensors Platinum RTD with 4-20mA transmitter:

1 Watertight enclosure, shielded from direct sunlight

2 Circulation fan

3 Watertight conduit fitting

D. Where called for in the sequences of operations, provide the following feature on space sensors and thermostats:

1. Security Sensors: Stainless-steel cover plate with insulated back and security screws

2. Space sensors with setpoint adjust: Plain white plastic cover with slide potentiometer to signal a setpoint adjustment to the DDC

3. Space Sensors with LCD display:

a. Operator buttons for adjusting setpoints, setting fans speeds and overriding unit to on/off

b. Graphical LCD icons for signaling heating/cooling mode, fans speed, schedule mode, actual temperature and current setpoint

E. Humidity Sensors shall meet the following specifications:

1. Bulk polymer sensor element

2. Accuracy: 2 percent full range with linear output

3. Room Sensors: With locking cover matching room thermostats, span of 0 to 100 percent relative humidity

4. Duct and Outside-Air Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity

F. Air Static Pressure Transmitter shall meet the following specifications:

1. Non-directional sensor with suitable range for expected input, and temperature compensated.

2. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.

3. Output: 4 to 20 mA.

4. Building Static-Pressure Range: 0 to 0.25 inches wg.

5. Duct Static-Pressure Range: 0 to 5 inches wg.

G. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; proportional output 4 to 20 mA.

H. Equipment operation sensors as follows:

1. Status Inputs for Fans: Differential-pressure switch with adjustable range of 0 to 5 inches wg.

2. Status Inputs for Pumps: Differential-pressure switch piped across pump with adjustable pressure-differential range of 8 to 60 psig.

3. Status Inputs for direct drive electric motors: Current-sensing relay with current transformers, adjustable and sized for 175 percent of rated motor current.

4. Status inputs for belt drive electric motors: Current sensing transmitter with linear 4-20mA output

I. Electronic Valve/Damper Position indication: Visual scale indicating percent of travel and 0 to 10 V dc, feedback signal.

J. Water-Flow Switches: Pressure-flow switches of bellows-actuated mercury or snap-acting type, with appropriate scale range and differential adjustment, with stainless-steel or bronze paddle. For chilled-water applications, provide vapor proof type.

K. Air Differential Pressure Switches: Diaphragm type air differential pressure switches with die cast aluminum housing, adjustable setpoint, minimum 5 amp switch rating at 120VAC, SPDT switches, and the switch pressure range shall be suited for the application. Provide Dwyer or equal. These switches shall be utilized for filter status.

L. Leak detectors: Provide spot leak detectors that can be secured to the floor or secured to a drain pan. The detection shall used a microchip controlled energized probes. The detector shall operate on 24Vor less. Provide a way to adjust the height of the leak probes. The SPDT contacts shall be inside a watertight enclosure.

2.8 AUTOMATIC CONTROL VALVES

A. General:

1. All automatic control valves shall be fully proportioning, unless specified otherwise. The valves shall be quiet in operation and fail-safe in either normally open or normally closed position in the event of control air failure. All valves shall be capable of operating at varying rates of speed to correspond to the exact dictates of the controllers and variable load re-quirements. The valves shall be capable of operating in sequence with other valves and/or dampers when required by the sequence of operation. All control valves shall be sized by the control vendor and shall be guaranteed to accommodate the flow rates as scheduled. All control valves shall be suitable for the pressure conditions and shall close against the differential pressures involved. Body pressure rating and connection type construction shall conform to fitting and valve schedules. Control valve operators shall be sized to close against a differential pressure equal to the design pump heads plus 10 percent.

2. Cold water, hot water and steam valves, throttling type, and bypass valves shall have equal percentage flow characteristics.

3. Unless otherwise specified, control valves 2 inches and smaller shall have cast iron or bronze bodies with screwed NPT connections.

4. Valves between 2-1/2 inch and 4 inch shall have cast iron bodies with flanged connections.

5. All automatic control valves installed exposed to the elements shall be provided with electric actuators with operating characteristics and accessories as described in herein. Coordinate with electrical contractor for power availability and point of connection.

6. All automatic control valves controlled by the BAS shall be furnished by the controls contractor unless noted otherwise in these documents.

7. All automatic control valves shall be installed by the mechanical trade.

8. The controls contractor shall provide wiring as follows:

a. All line voltage power for electric valve actuators shall be wired by the controls contractor from the nearest available power panel. Coordinate with electrical trade.

b. All wiring between the central control system (ATC/BMS) and the valve actuator shall be wired by the controls contractor.

c. All wiring between the valve actuator and their associated thermostats, pressure switches, control devices, etc. shall be wired by the controls contractor.

d. All wiring shall comply with code requirements. Segregate high and low voltage wiring & circuits and segregate the FAS and controls (BMS) terminals.

B. Threaded Valves, line size ½" to 2"

1. Controlled Media Specific Items

a. The control valve shall be suitable for chilled water to a minimum of 35°F (2°C) and hot water to a maximum temperature of 250°F (121°C). 3-way 1-1/2 inch and 2 inch valves shall be suitable for chilled water to a minimum of 35°F (2°C) and hot water to a maximum temperature of 230°F (110°C).

b. The control valve shall be suitable for up to 50% ethylene or propylene glycol solutions, chilled glycol/water solutions to a minimum of 35°F (2°C) and hot glycol/water solutions to a maximum temperature of 250°F (121°C). 3-way 1-1/2 inch and 2 inch valves shall be suitable for up to 50% ethylene or propylene glycol solutions, chilled glycol/water solutions to a minimum of 35°F (2°C) and hot glycol/water solutions to a maximum temperature of 230°F (110°C).

c. General Construction Materials/Applicable Standards

1 Control valve bodies shall be constructed of forged brass according to ASTM B283 (C37700, CuZn39Pb2 or equivalent), and shall meet requirements of ANSI 250 and 600WOG pressure classes.

2 Inlets and outlets shall be clearly marked on the valve bodies.

3 Valve ball shall consist of nickel-plated brass, chrome-plated brass or stainless steel.

4 End connections shall be NPT internally threaded according to ANSI B1.20.1.

5 The control valve flow rate (Cv) shall meet the requirements of ANSI/ISA S75.02.

6 The control valve shall have an equal percentage flow characteristic, according to ANSI/ISA S75.11. A single glass filled PTFE V port insert shall provide both the ball seal and shall establish the flow coefficient of the valve. The V port insert shall be retained by the valve body itself, not requiring additional retaining components. Flow coefficient adapters requiring a retainer clip, or installed after final assembly of the valve or as inserts in the ball shall not be allowed.

7 2-way valves and the A-AB path on 3-way valves shall meet the requirements of ANSI Class IV (0.01% of rated Cv) seat leakage, or better, according to ANSI/FCI 70.2, at the specified close-off pressure. Bypass path (B-AB) on 3-way valves shall meet the requirements of ANSI Class III (0.1% of rated Cv) seat leakage, or better, according to ANSI/FCI 70.2.

8 Chilled and Hot water valve shall have a blow-out proof stem with two EPDM (peroxide cured) O-rings. External stem retainers will not be allowed.

9 Valve stem shall be made of brass or stainless steel.

10 Valve shall have the ability to be manually operated in the event of a power failure.

C. Actuators - Electric

1. The valves shall be provided with an actuator by the same manufacturer, factory installed.

2. All actuators shall have visual position indication.

3. No external programming device shall be required.

4. Actuator shall be electric motor driving, microprocessor signal controlled.

5. Modulating valves shall be positive positioning, responding to a 0-10VDC, 2-10VDC or 4-20mA signal. Floating modulating signals are acceptable for modulation on terminal units and radiation units. There shall be a visual valve position indicator.

6. Power: All actuators shall be 24VAC power and less than 100VA draw. Power shall be via Class 2 wiring. Actuators requiring more than 100VA shall have a dedicated conduit for power wiring, not mixed with the signal wiring.

7. Fail Safe: Valves actuators shall position the valve in a fail-safe position when the power supply is disrupted or the signal goes to 0. Fail-safe according to the following guidelines unless otherwise stated in the sequence of operations

   a. Power fail safe shall be via spring loaded mechanical means

   b. Any AHU hot water exposed to ventilation air shall fail open

   c. AHU Chilled water coils exposed to ventilation air in possible freezing conditions shall be fail open

   d. AHU Chilled water coils that are drained in winter months or are in climate zones without freezing conditions shall be fail-in-place

   e. Terminal unit valves shall fail-in-place

   f. Fail in Safe valves on primary equipment such as chilled water systems, hot water systems and condenser water systems shall have a means to manually open the valve when power is not available, such as a hand wheel or a geared crank with a clutch.

   g. The actuator shall be designed with a current limiting motor protection. A release button (clutch) or handle on the actuator shall be provided to allow for manual override (except when actuator is spring return type).

   h. Actuator shall provide minimum torque required for proper valve close-off. The close-off differential pressure rating of the valve shall exceed the highest possible head pressure available at the pump plus 10%, and still be rated for a Class IV leakage.

   i. The actuator shall have the capability of adding auxiliary switches or feedback potentiometer if specified.

   j. All automatic control valves installed in locations exposed to the elements shall be provided with weather resistant housings and heaters for climates that reach below freezing.

   k. Actuators shall be UL and CSA listed.

D. Hot Water / Condenser Water / Control Valves

1. Single-seated.

2. Fully proportioning with modulating plug or V-port inner valves.

3. Body pressure rating and connection type construction shall conform to fitting and valve schedules. The ANSI rating of the valve shall match the ANSI rating of the piping in which the valve is installed. Minimum ANSI rating shall be ANSI 125.

4. Stainless steel stems and trim.

5. Spring loaded Teflon packing

6. Quiet in operation.

7. Fail-safe in either normally open or normally closed position in the event of power failure.

8. Capable of operating in sequence with other valves and/or dampers when required by the sequence of operation.

9. Capable of operating at varying rates of speed to correspond to the exact dictates of the controller and variable load requirements.

2.9 ELECTRONIC ACTUATOR SPECIFICATION

A. ELECTRONIC VALVE ACTUATORS

1. Actuator shall be fully modulating, floating (tri-state), two position, and/or spring return as indicated in the control sequences. Specified fail safe actuators shall require mechanical spring return.

2. Modulating valves shall be positive positioning, responding to a 2-10VDC or 4-20mA signal. There shall be a visual valve position indicator.

3. The actuator shall have the capability of adding auxiliary switches or feedback potentiometer if specified.

4. Actuator shall provide minimum torque required for proper valve close-off. The actuator shall be designed with a current limiting motor protection. A release button (clutch) or handle on the actuator shall be provided to allow for manual override (except when actuator is spring return type).

5. Actuators shall be UL listed.

B. ELECTRONIC DAMPER ACTUATORS

1. Actuator shall be direct coupled (over the shaft), enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The actuator-to-shaft clamp shall use a "V" bolt and "V" shaped, toothed cradle to attach to the damper shaft for maximum holding strength. Single bolt or set screw type fasteners are not acceptable.

2. Actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator. End switches to deactivate the actuator at the end of rotation or magnetic clutch are not acceptable.

3. For power-failure/safety applications, a mechanical, spring return mechanism shall be used.

4. Actuators with spring return mechanisms shall be capable of either clockwise or counterclockwise spring return operation by simply changing the mounting orientation.

5. Proportional actuators shall accept a 2-10VDC, 4-20mA signal, or be of the 2 point floating type and provide a 2-10VDC actuator position feedback signal.

6. All actuators shall have an external manual gear release (clutch) or manual crank to aid in installation and for allowing manual positioning when the actuator is not powered.

7. All actuators shall have an external direction of rotation switch to aid in installation and to allow proper control response.

8. Actuators shall be provided with a factory-mounted 3-foot electrical cable and conduit fitting to provide easy hook-up to an electrical junction box.

9. Actuators shall be listed under Underwriters Laboratories Standard 873 and Canadian Standards Association. They must be manufactured under ISO 9001.

PART 3 EXECUTION

3.1 EXAMINATION

A. The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the architect/engineer for resolution before rough-in work is started.

B. The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the engineer for resolution before rough-in work is started.

C. The contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate—or if any discrepancies occur between the plans and the contractor's work and the plans and the work of others—the contractor shall report these discrepancies to the engineer and shall obtain written instructions for any changes necessary to accommodate the contractor's work with the work of others.

3.2 INSTALLATION

A. Provide all relays, switches, and all other auxiliaries, accessories and connections necessary to make a complete operable system in accordance with the sequences specified. All field wiring shall be by this contractor.

B. Install controls so that adjustments and calibrations can be readily made. Controls are to be installed by the control equipment manufacturer.

C. Mount surface-mounted control devices on brackets to clear the final finished surface on insulation.

D. Install equipment level and plumb.

E. Install control valves horizontally with the power unit up.

F. Unless otherwise noted, install wall mounted thermostats and humidistat 60" above the floor measured to the center line of the instrument, or as otherwise directed by the Architect.

G. Install averaging elements in ducts and plenums in horizontal crossing or zigzag pattern.

H. Install outdoor sensors in perforated tube and sunshield.

I. Install damper motors on outside of duct in protected areas, not in locations exposed to outdoor temperatures.

J. Install labels and nameplates on each control panel listing the name of the panel referenced in the graphics and a list of equipment numbers served by that panel.

K. Furnish hydronic instrument wells, valves, and other accessories to the mechanical contractor for installation.

L. Furnish automatic dampers to mechanical contractor for installation.

3.3 ELECTRICAL WIRING SCOPE

A. This contractor shall be responsible for power that is not shown on the electrical drawings, to controls furnished by this contractor. If power circuits are shown on the electrical drawings, this contractor shall continue the power run to the control device. If power circuits are not shown, this contractor shall coordinate with the electrical contractor to provide breakers at distribution panels for power to controls. This contractor is then responsible for power from the distribution panel.

1. Coordinate panel locations. If enclosures for panels are shown on the electrical drawings, furnish the enclosures according to the electrician's installation schedule.

B. This contractor shall not be responsible for power to control panels and control devices that are furnished by others, unless it is part of the control interlock wiring.

C. Refer to Coordination section for what devices this contractor is responsible to mount and which are turned over to others to mount.

D. This contractor shall be responsible for wiring of any control device that is furnished as part of this section of specification.

E. Interlock wiring shall be run in separate conduits from BAS associated wiring.

F. Provide network wiring for equipment that is called to be integrated to the BAS.

3.4 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. All low voltage control wiring shall be class 2. Control wiring that is not class 2 shall be run in separate conduits from class 2 wiring.

B. Floor level network wiring between terminal units can be combined with thermostat and other low voltage wiring in the same conduit. All other network wiring shall be in dedicated conduits.

C. Install raceways, boxes, and cabinets according to Division 26 Section "Raceways and Boxes."

D. Install building wire and cable according to Division 26 Section "Conductors and Cables."

E. Installation shall meet the following requirements:

1. Conceal cable and conduit, except in mechanical rooms and areas where other conduit and piping are exposed.

2. Install exposed cable in raceway or conduit.

3. Install concealed cable using plenum rated cable.

4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.

5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.

6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.

7. All wiring in lab areas shall be in conduit.

8. All unsupported risers shall be rigid steel conduit. Supported risers shall be EMT.

F. Rigid conduit shall be steel, hot dip galvanized, threaded with couplings, ¾ inch minimum size, manufactured in accordance with ANSI C-80-1. Electrical metallic tubing (EMT) with compression fittings or intermediate metallic conduit (IMC) may be used as conduit or raceway where permitted by the NEC.

G. Concealed control conduit and wiring shall be provided in all spaces except in the Mechanical Equipment Rooms and in unfinished spaces. Install in parallel banks with all changes in directions made at 90 degree angles.

H. Install conduit adjacent to machine to allow service and maintenance.

I. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

J. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

K. Ground equipment.

3.5 COMMUNICATION WIRING

A. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer’s installation recommendations for all communication cabling.

B. Do not install communication wiring in raceway and enclosures containing Class 1 wiring.

C. Maximum pulling, tension, and bend radius for cable installation, as specified by the cable manufacturer, shall not be exceeded during installation.

D. Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.

E. Cable bundling:

1. RS485 cabling run open air in accessible areas can be bundled with other class 2 low voltage cabling.

2. RS485 cabling run between terminal units in conduits above ceilings or under floors or in inaccessible areas can be bundled with other class 2 low voltage cabling.

3. RS485 cabling run between floors shall be in a communication only conduit.

4. RS485 conduit run long distances between utility rooms or between buildings shall be in a communication only conduit.

5. Ethernet cabling shall be in a communication only conduit.

6. Ethernet and RS485 can be run together.

7. Fiber optics can be run with Ethernet and RS485 cabling as long as the conduit is bent to fiber optic standards and junction boxes are sized for fiber optic use.

F. RS485 Cabling

1. RS485 cabling shall be used for BACnet MS/TP networks.

2. RS485 shall use low capacitance, 20-24 gauge, twisted shielded pair.

3. The shields shall be tied together at each device.

4. The shield shall be grounded at one end only and capped at the other end.

5. Provide end of line (EOL) termination devices at each end of the RS485 network or subnetwork run, to match the impedance of the cable, 100 to 120ohm.

G. Ethernet Cabling

1. Ethernet shall not be run with any Class 1 or low voltage Class 2 wiring.

2. CAT6, unshielded twisted pair (UTP) cable shall be used for BAS Ethernet.

3. Solid wire shall be used for long runs, between mechanical rooms and between floors. Stranded cable can be used for patch cables and between panels in the same mechanical room up to 50 feet away.

4. When the BAS Ethernet connects to an Owner's network switch, document the port number on the BAS As-builts.

H. Fiber-Optic Cabling

1. Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post-installation residual cable tension shall be within cable manufacturer's specifications.

2. All cabling and associated components shall be installed in accordance with manufacturers' instructions. Minimum cable and unjacketed fiber bend radii, as specified by cable manufacturer, shall be maintained.

3. All terminations shall to be made into a patch panel, designed for such use. Free air terminations with patch panels are prohibited.

I. When a cable enters or exits a building, a lightning arrestor must be installed between the lines and ground. The lighting arrestor shall be installed according to the manufacturer's instructions.

J. All runs of communication wiring shall be unspliced length when that length is commercially available.

K. All communication wiring shall be labeled to indicate origination and destination data.

L. Grounding of coaxial cable shall be in accordance with NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

3.6 IDENTIFICATION

A. Permanent warning labels shall be affixed to all equipment that can be automatically started by the DDC system.

1. Labels shall use white lettering (12-point type or larger) on a red background.

2. Warning labels shall read as follows: C A U T I O N This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to "Off" position before servicing.

B. Permanent warning labels shall be affixed to all motor starters and all control panels that are connected to multiple power sources utilizing separate disconnects.

1. Labels shall use white lettering (12-point type or larger) on a red background.

2. Warning labels shall read as follows: C A U T I O N This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing.

C. Control Equipment and Device labeling:

1. Labels and tags shall match the unique identifiers shown on the as-built drawings.

2. All Enclosures shall be labeled to match the as-built drawing by either control panel name or the names of the DDC controllers inside.

3. All sensors and actuators not in occupied areas shall be tagged.

4. Airflow measurement arrays shall be tagged to show flow rate range for signal output range, duct size, and pitot tube AFMS flow coefficient.

5. Duct static pressure taps shall be tagged at the location of the pressure tap.

6. Each device inside enclosures shall be tagged.

7. Terminal equipment need only have a tag for the unique terminal number, not for each device. Match the unique number on:

a. First, the design drawings, or

b. Second, the control as-builts, or

c. Third, the DDC addressing scheme

d. Tags on the terminal units shall be displayed on the Operator Workstation Graphics.

D. Tags shall be mechanically printed on permanent adhesivebacked labeling strips, 12 point height minimum.

E. Manufacturers' nameplates and UL or CSA labels are to be visible and legible after equipment is installed.

F. Identification of Wires

1. Tag each wire with a common identifier on each end of the wire, such as in the control panel and at the device termination.

2. Tag each network wire with a common identifier on each end.

3. Tag each 120V power source with the panel and breaker number it is fed by.

G. Identification of Conduits:

1. Identify the low voltage conduit runs as BAS conduit, power feeds not included.

2. Identify each electric box, junction box, utility box and wiring tray with a blue paint mark or blue permanent adhesive sticker.

3. For conduit runs that run more than 8 ft between junction boxes in 1 room, place a blue identifier at least every 8 feet.

4. Place a blue identifier on each side of where a conduit passed through a wall or other inaccessible path.

5. Identify all BAS communication conduits the same as above.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove malfunctioning units, replace with new units, and retest.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment, and retest.

3. Calibration test controllers by disconnecting input sensors and stimulating operation with compatible signal generator.

B. Replace damaged or malfunctioning controls and equipment.

1. Start, test, and adjust control systems.

2. Demonstrate compliance with requirements, including calibration and testing, and control sequences.

3. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.

3.8 SYSTEM CHECKOUT AND STARTUP

A. Inspect each termination in the MER control panels and devices to make sure all wires are connected according to the wiring diagrams and all termination are tight.

B. After the controls devices and panels are installed and power is available to the controls, perform a static checkout of all the points, including the following:

1. Inspect the setup and reading on each temperature sensor against a thermometer to verify its accuracy.

2. Inspect the setup and reading on each humidity sensor against a hygrometer to verify its accuracy.

3. Inspect the reading on each CO2 sensor using a calibration kit to verify the sensor range accuracy matches the DDC setup.

4. Inspect the reading of each status switch to verify the DDC reads the open and close correctly.

5. Command each relay to open and close to verify its operation.

6. Command each 2-position damper actuator to open and close to verify operation.

7. Command each 2-position valve to open and close to verify operation.

8. Ramp each modulating actuator to 0%, 25%, 50%, 75% and 100% to verify its operation.

9. Ramp each modulating output signal, such as a VFD speed, to verify its operation.

10. Test each safety device with a real life simulation, for instance check low temperature detectors with ice water, water detectors with water, etc.

C. Document that each point was verified and operating correctly. Correct each failed point before proceeding to the dynamic startup.

D. Verify that each DDC controller communicates on its respective network correctly.

E. After all of the points are verified, and power is available to the mechanical system, coordinate a startup of each system with the mechanical contractor. Include the following tests:

1. Start systems from DDC.

2. Verify that each setpoint can be met by the system.

3. Change setpoints and verify system response.

4. Change sensor readings to verify system response.

5. Test safety shutdowns.

6. Verify time delays.

7. Verify mode changes.

8. Adjust filter switches and current switches for proper reactions.

9. Adjust proportional bands and integration times to stabilize control loops.

F. Perform all program changes and debugging of the system for a fully operational system.

G. Verify that all graphics at the operator workstations correspond to the systems as installed. Verify that the points on the screens appear and react properly. Verify that all adjustable setpoints and manual commands operate from the operator workstations.

H. After the sequence of operation is verified, setup the trends that are listed in the sequence of operations for logging and archiving for the commissioning procedure.

3.9 SYSTEM COMMISSIONING, DEMONSTRATION AND TURNOVER

A. The BAS Contractor shall prepare and submit for approval a complete acceptance test procedure including submittal data relevant to point index, functions, sequence, inter-locks, and associated parameters, and other pertinent information for the

operating system. Prior to acceptance of the BAS by the Owner and Engineer, the BAS contractor shall completely test the BAS using the approved test procedure.

B. After the BAS contractor has completed the tests and certified the BAS is 100% complete, the Engineer shall be requested, in writing, to approve the satisfactory operation of the system, sub-systems and accessories. The BAS contractor shall submit Maintenance and Operating manuals at this time for approval. An acceptance test in the presence of the Engineer and Owner's representative shall be performed. The Owner will then shake down the system for a fixed period of time (30 days).

C. The BAS contractor shall fix punch list items within 30 days of acceptance.

D. When the system performance is deemed satisfactory in whole or in part by these observers, the system parts will be accepted for beneficial use and placed under warranty.

3.10 TRAINING

A. During System commissioning and at such time as acceptable performance of the Building Automation System hardware and software has been established, the BAS contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction during normal working hours shall be performed by a competent building automation contractor representative familiar with the Building Automation System's software, hardware and accessories.

B. At a time mutually agreed upon, during System commissioning as stated above, the BAS contractor shall give 8 hours of onsite training on the operation of all BAS equipment. Describe its intended use with respect to the programmed functions specified. Operator orientation of the automation system shall include, but not be limited to:

1. Explanation of drawings and operator’s maintenance manuals.
2. Walk-through of the job to locate all control components.
3. Operator workstation and peripherals.
4. DDC Controller and ASC operation/sequence.
5. Operator control functions including scheduling, alarming, and trending.
6. Explanation of adjustment, calibration and replacement procedures.

C. Additional 8-hours of training shall be given after the 30 day shakedown period.

D. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Contractor. If the Owner requires such training, it will be contracted at a later date. Provide description of available local and factory customer training. Provide costs associated with performing training at an off-site classroom facility and detail what is included in the manufacturer’s standard pricing such as transportation, meals, etc.

END OF 23 09 00

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Hydronic system requirements.

B. Heating water piping, above grade.

C. Heating water and glycol piping, above grade.

D. Equipment drains and overflows.

E. Pipe hangers and supports.

F. Unions, flanges, mechanical couplings, and dielectric connections.

G. Valves:

1. Ball valves.
2. Butterfly valves.
3. Check valves.

1.2 RELATED REQUIREMENTS

A. Section 23 0553 - Identification for HVAC Piping and Equipment.

B. Section 23 0719 - HVAC Piping Insulation.

C. Section 23 2114 - Hydronic Specialties.

1.3 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2018.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2018.

D. ASME B31.9 - Building Services Piping; 2020.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2020.

F. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2019.

G. ASTM B32 - Standard Specification for Solder Metal; 2020.

H. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2020.

I. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992, with Editorial Revision (2018).

J. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

K. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding.; 2011 and errata.

L. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.

M. AWWA C606 - Grooved and Shouldered Joints; 2015.

N. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018 (Amendent 2019).

1.4 SUBMITTALS

A. Product Data:

1. Include data on pipe materials, pipe fittings, valves, and accessories.

2. Provide manufacturers catalog information.

3. Indicate valve data and ratings.

4. Show grooved joint couplings, fittings, valves, and specialties on drawings and product submittals, specifically identified with the manufacturer's style or series designation.

B. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

PART 2 PRODUCTS

2.1 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers, and supports as required, as indicated, and as follows:

1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.

2. Use non-conducting dielectric connections whenever jointing dissimilar metals.

3. Grooved mechanical joints may be used in accessible locations only.

a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Architect.

b. Use rigid joints unless otherwise indicated.

4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

D. Valves: Provide valves where indicated:

1. Provide drain valves where indicated, and if not indicated, provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch (20 mm) gate valves with cap; pipe to nearest floor drain.

2. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings.

3. For throttling, bypass, or manual flow control services, use globe, ball, or butterfly valves.

4. For throttling and isolation service in chilled and condenser water systems, use only butterfly valves.

5. In heating water, chilled water, or condenser water systems, butterfly valves may be used interchangeably with gate and globe valves.

2.2 HEATING WATER AND GLYCOL PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:

1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.

2. Threaded Joints: ASME B16.3, malleable iron fittings.

3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn, using one of the following joint types:

1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.

a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

b. Braze: AWS A5.8M/A5.8 BCuP copper/silver alloy.

c. Braze: {\rs\#1} BCuP copper/silver alloy.

2. Grooved Joints: AWWA C606 grooved tube, fittings of same material, and copper-tube-dimension mechanical couplings.

3. Mechanical Press Sealed Fittings: Double pressed type complying with ASME B16.22, utilizing EPDM, nontoxic synthetic rubber sealing elements.

2.3 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn; using one of the following joint types:

1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

2.4 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inches (13 to 38 mm): Malleable iron, adjustable swivel, split ring.

3. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and Greater: Carbon steel, adjustable, clevis.

4. Hangers for Hot Pipe Sizes 2 to 4 Inches (50 to 100 mm): Carbon steel, adjustable, clevis.

5. Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Greater: 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 6 Inches (150 mm) and Greater: Steel channels with welded spacers and hanger rods, cast iron roll.

8. Vertical Support: Steel riser clamp.

9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

10. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

11. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.5 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe of 2 Inches (50 mm, DN) and Less:

1. Ferrous Piping: 150 psi (1034 kPa) brass or malleable iron, threaded.

2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe 2 Inches (50 mm, DN) and Greater:

1. Ferrous Piping: 150 psig (1034 kPa) forged steel, slip-on.

C. Dielectric Connections:

1. Unions:

a. 1/2 to 1 Inches (15 to 25 mm): Brass solder to galvanized FPT.

b. 1/2 to 2 Inches (15 to 50 mm): Brass solder to galvanized FPT.

c. 1/2 to 1 Inches (15 to 25 mm): Brass to galvanized FPT or FIP (Female Iron Pipe).

d. 3/4 to 1/2 Inch (20 to 15 mm) Reducer: Brass solder to galvanized FPT.

e. Service: 250 psi (1,723.6 kPa), minus 20 to 180 deg F (minus 28.9 to 82.2 deg F).

2.6 BALL VALVES

A. Manufacturers:

1. Apollo Valves: www.apollovalves.com/#sle.

2. Conbraco Industries: www.apollovalves.com.

3. Grinnell Products: www.grinnell.com/#sle.

4. Substitutions: See Section 01 6000 - Product Requirements.

B. Up To and Including 2 Inches (50 mm):

1. Bronze one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.

2.7 BUTTERFLY VALVES

A. Manufacturers:

1. Anvil International: www.anvilintl.com/#sle.
2. Apollo Valves: www.apollovalves.com/#sle.
3. Grinnell Products: www.grinnell.com/#sle.

B. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck.

C. Disc: Construct of aluminum bronze, chrome plated ductile iron, stainless steel, ductile iron with EPDM encapsulation, Buna-N encapsulation, or _____.

D. Operator: 10 position lever handle.

E. Grooved end Butterfly Valve: 300 psi CWP suitable for bidirectional and dead-end service at full rated pressure. Body shall be grooved end black enamel coated ductile iron conforming to ASTM A536. Disc shall be electroless nickel plated ductile iron with blowout proof 416 stainless steel stem. Disc shall be offset from the stem centerline to allow full 360 degree seating. Seat shall be pressure responsive EPDM. Valve bearings shall be TFE lined fiberglass, and stem seals shall be of the same grade elastomer as the valve seat. Valve shall be complete with ISO flange for actuation mounting. Valve operators shall be lever handle or gear operator, available with memory stop feature, locking device, chainwheel, or supplied bare. Basis of Deign: Victaulic S/761, S/461

2.8 SPRING LOADED CHECK VALVES

A. Manufacturers:

1. Anvil International: www.anvilintl.com/#sle.
2. Shurjoint Piping Products, Inc: www.shurjoint.com/#sle.
3. Victaulic Company: www.victaulic.com/#sle.

B. Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer, or threaded lug ends.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare piping connections to equipment using jointing system specified.

E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

F. After completion, fill, clean, and treat systems. See Section 23 2500 for additional requirements.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner, parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and to avoid interference with use of space.

D. Group piping whenever practical at common elevations.

E. Sleeve pipe passing through partitions, walls, and floors.

F. Slope piping and arrange to drain at low points.

G. Grooved Joints:

1. Pipe ends shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove for proper gasket sealing. The gasket style and elastomeric material shall be verified as suitable for the intended service as specified. Flexible couplings only to be used for expansion loops, pump trim and where approved by the engineer. A factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and product installation. All groove depths shall be checked manually or by grooving tool (RG5200i). A Victaulic representative shall periodically visit the job site and review installation.

H. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.

2. Support horizontal piping as scheduled.

3. Install hangers to provide minimum 1/2-inch (13 mm) space between finished covering and adjacent work.

4. Place hangers within 12 inches (300 mm) of each horizontal elbow.

5. Use hangers with 1-1/2 inches (38 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.

7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

8. Provide copper plated hangers and supports for copper piping.

I. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. See Section 23 0719.

J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welds.

K. Install valves with stems upright or horizontal, not inverted.

3.3 PRESSURE TESTS

A. Piping shall be tight under test and shall not show loss in pressure or visible leaks, during test operations or after the minimum duration of time as specified. Remove piping which is not tight under test; remake joints and repeat test until no leaks occur.

B. Take measures to protect all personnel from the potential of ruture of components during testing of systems.

C. Hydrostatically pressure test piping in accordance with International Mechanical Code Section 1208 and ASME Code for Pressure Piping B31.9 Building Services Piping Chapter IV.

D. Circulating water systems, including propylene glycol solution systems and cold water make-up piping connections to heating, ventilating, air conditioning and refrigeration systems, unless otherwise specified:

1. Before final connections are made perform hydrostatic test at 1-1/2 times the maximum system design pressure, but not less than 100 psig, for not less than 15 minutes.

2. After final connections are made perform hydrostatic retest at a pressure equal to maximum operating system design pressure, but not less than 30 psig, for 4 hours.

E. Equipment and Appurtenances:

1. Hot Water Boilers: Perform hydrostatic test at 30 psig, after installation, with piping connections shut-off.

2. Relief Valves: Increase pressure in equipment or apparatus to relief valve setting, to test opening of valves at required relief pressures.

3.4 SCHEDULES

A. Hanger Spacing for Copper Tubing.

1. 1/2 Inch (15 mm) and 3/4 inch (20 mm): Maximum span, 5 feet (1500 mm); minimum rod size, 1/4 inch (6 mm).

2. 1 Inch (25 mm): Maximum span, 6 feet (1800 mm); minimum rod size, 1/4 inch (6 mm).

3. 1-1/2 Inches (40 mm) and 2 Inches (50 mm): Maximum span, 8 feet (2400 mm); minimum rod size, 3/8 inch (9 mm).

B. Hanger Spacing for Steel Piping.

1. 1/2 Inch (15 mm), 3/4 Inch (20 mm), and 1 Inch (25 mm): Maximum span, 7 feet (2100 mm); minimum rod size, 1/4 inch (6 mm).

2. 1-1/4 Inches (32 mm): Maximum span, 8 feet (2400 mm); minimum rod size, 3/8 inch (9 mm).

3. 1-1/2 Inches (40 mm): Maximum span, 9 feet (2700 mm); minimum rod size, 3/8 inch (9 mm).

4. 2 Inches (50 mm): Maximum span, 10 feet (3.0 m); minimum rod size, 3/8 inch (9 mm).

5. 2-1/2 Inches (65 mm): Maximum span, 11 feet (3.4 m); minimum rod size, 3/8 inch (9 mm).

6. 3 Inches (80 mm): Maximum span, 12 feet (3.6 m); minimum rod size, 3/8 inch (9 mm).

7. 4 Inches (100 mm): Maximum span, 14 feet (4.3 m); minimum rod size, 1/2 inch (13 mm).

8. 6 Inches (150 mm): Maximum span, 17 feet (5.1 m); minimum rod size, 1/2 inch (13 mm).

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Expansion tanks.

B. Air vents.

C. Air separators.

D. Strainers.

E. Triple Duty Valves.

F. Balancing valves.

G. Relief valves.

H. Glycol specialties.

1.2 RELATED REQUIREMENTS

A. Section 23 2113 - Hydronic Piping.

1.3 REFERENCE STANDARDS

A. ASME (BPV VIII, 1) - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; The American Society of Mechanical Engineers; 2007.

1.4 SUBMITTALS

A. Product Data: Manufacturer's catalog sheets, specifications, and installation instructions for all items specified.

PART 2 PRODUCTS

2.1 BLADDER-TYPE EXPANSION TANKS

A. Manufacturers:

1. ITT Bell & Gossett.
2. Armstrong International, Inc.
3. Taco, Inc.

B. Construction: Welded steel, tested and stamped in accordance with ASME (BPV VIII, 1); supplied with National Board Form U-1, rated for working pressure of 125 psi, with replaceable heavy duty butyl rubber bladder, and steel support stand.

C. Accessories: Pressure gage and air-charging fitting, tank drain; precharge to 12 psi.

D. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure back flow preventer, test cocks, strainer, vacuum breaker, and valved by-pass.

2.2 AIR VENTS

A. Manufacturers:

1. ITT Bell & Gossett.
2. Armstrong International, Inc.
3. Taco, Inc.

B. Manual Type: Provide manual vent air vent valves designed to be operated manually with a screw driver or thumbscrew and 1/8" NPT connection.

C. Automatic Type: Provide float type automatic air vent valves with cast iron body, stainless steel float and mechanisms, pressure rated for 125 psi, with 1/2" NPT connections.

2.3 AIR SEPARATORS

A. In-line Air Separators:

1. Manufacturers:
   a. ITT Bell & Gossett.
   b. Armstrong International, Inc.
   c. Taco, Inc.
2. Cast iron for sizes 1-1/2 inch and smaller, or steel for sizes 2 inch and larger; tested and stamped in accordance with ASME (BPV VIII, 1); for 125 psi operating pressure.

B. Combination Air Separators/Strainers:

1. Manufacturers:
   a. ITT Bell & Gossett.
   b. Armstrong International, Inc.
   c. Taco, Inc.
2. Steel, tested and stamped in accordance with ASME (BPV VIII, 1); for 125 psi operating pressure, with integral bronze strainer, tangential inlet and outlet connections, and internal stainless steel air collector tube.

2.4 STRAINERS

A. Manufacturers:

1. Armstrong International, Inc.
2. Green Country Filtration.
3. Victaulic
4. WEAMCO.

B. Size 2 inch and Under:

1. Screwed brass or iron body for 175 psi working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

C. Size 2-1/2 inch to 4 inch:

1. Flanged iron body for 175 psi working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

2.5 SUCTION DIFFUSERS

A. Manufacturers:

1. ITT Bell & Gossett.

2. Armstrong International Inc.

3. Victaulic

4. Taco, Inc.

B. Fitting: Angle pattern, cast-iron body, threaded for 2 inch and smaller, flanged for 2-1/2 inch and larger, rated for 175 psi working pressure. Provide full length flow straightening vanes of length no less than 2-1/2 times the pump suction diameter to provide nonturbulent flow to the pump suction. Diffuser shall have stainless steel combination diffuser-strainer-orifice cylinder with 3/16 inch diameter openings designed to withstand pressure equal to pump shut-off head, and disposable fine mesh strainer to fit over cylinder strainer.

C. Accessories: Adjustable foot support, blowdown tapping in bottom, gage tapping in side.

2.6 TRIPLE DUTY VALVES

A. Manufacturers:

1. ITT Bell & Gossett.

2. Armstrong International Inc.

3. Victaulic

4. Taco, Inc.

B. Valves: Straight or angle pattern, flanged cast-iron valve body with bolt-on bonnet for 175 psi operating pressure, non-slam check valve with spring-loaded bronze disc and seat, stainless steel stem, and calibrated adjustment permitting flow regulation.

2.7 VIBRATION ISOLATION PUMP DROPS

A. Factory assembled grooved end vibration isolation pump drop for pipe sizes 3” through 12”. Orange enamel coated assembly, consisting of a Class 150 flange for pump connection

1. Suction Pump Drop: consisting of a suction diffuser with stainless steel basket, butterfly valve with offset stem for 360-degree circumferential seating, and pipe spool with thermometer and pressure ports. Assembly is installation-ready, with flexible couplings to accommodate vibration attenuation and stress relief. Assembly rated for working pressure to 300-psig. Basis of Design: Victaulic Series 381.

2. Discharge Pump Drop: Tri-service valve assembly consisting of a spring-actuated Venturi-Check valve and butterfly valve with offset stem for 360-degree circumferential seating, and pipe spool with thermometer and pressure ports. Assembly is installation-ready, with flexible couplings to accommodate vibration attenuation and stress relief. Assembly rated for working pressure to 300-psig. Basis of design: Victaulic Series 380.

2.8 AUTOMATIC BALANCING VALVES

A. Manufacturers:

1. ITT Bell & Gossett.
2. Victaulic
3. Approved Equal.

B. Construction: Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet with blowdown/backflush drain, with integral automatic flow rate cartridge. EPDM O-rings.

C. Calibration: Automatically control flow within 5 percent of selected rating, over operating differential pressure range 2 to 60 psi.

D. Control Mechanism: Stainless steel or nickel plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring.

E. Accessories: In-line strainer on inlet and ball valve on outlet.

2.9 RELIEF VALVES

A. Manufacturers:

1. ITT Bell & Gossett.
2. Armstrong International, Inc.
3. Myson Company.

B. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.10 GLYCOL SYSTEM

A. Manufacturers:

1. Neptune Chemical Pump co. Inc., Model G-50.
2. J. L. Wingert Company.
3. ITT Bell & Gossett.

B. General: Preassembled packaged glycol feed system complete with one 1.5 gpm (@100psi) pumps, low level light and audible alarm, seperate discharges and pressure switches to allow the feeding of two seperate closed loop systems independently from a single tank.

C. Tank: 50 gallon polyethylene tank mounted in a four-leg carbon steel stand with upper and lower steel support bands. Tank stand shall be factory painted.

D. Panel: 120 Volt single Phase control panel with NEMA 4X enclosure consisting of the following shall be provided:

1. H-O-A selector switch with running light and magnetic starter for feed pump. In Auto, the pump is operated by the skid-mounted differential (adjustable) pressure switch and interlocked to a low level float switch mounted in the side of the tank. Pnael shall be mounted to the tank frame. All electrical components shall be wired in conduit to control panel.

E. Glycol Solution:

1. Inhibited propylene glycol and water solution mixed 40 percent glycol - 60 percent water, suitable for operating temperatures from -40 degrees F to 250 degrees F.

PART 3 EXECUTION

3.1 INSTALLATION

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

B. Where large air quantities can accumulate, provide enlarged air collection standpipes.

C. Provide manual air vents at system high points and as indicated.

D. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

E. Provide air separator on discharge side of system circulation pump and connect to expansion tank.

F. Provide valved drain and hose connection on strainer blow down connection.

G. Provide pump suction fitting on suction side of base mounted centrifugal pumps where indicated. Remove temporary strainers after cleaning systems.

H. Provide combination pump discharge valve on discharge side of base mounted centrifugal pumps where indicated.

I. Support pump fittings with floor mounted pipe and flange supports.

J. Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks.

K. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

L. Pipe relief valve outlet to nearest floor drain.

M. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

N. Clean and flush glycol system before adding glycol solution. Refer to Section 23 2500.

O. Feed glycol solution to system through make-up line with pressure regulator, venting system high points.

P. Perform tests determining strength of glycol and water solution and submit written test results.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. In-line pumps.

1.2 RELATED REQUIREMENTS

A. Section 23 2113 - Hydronic Piping.

B. Section 23 2114 - Hydronic Specialties.

1.3 REFERENCE STANDARDS

A. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2009, Revision 1 - 2010.

B. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 2008.

C. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

D. UL 778 - Standard for Motor-Operated Water Pumps; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

E. ASHRAE 90.1-2010- American Society of Heating, Refrigeration and Air Conditioning Engineers.

F. New York State Energy Code; Current Adopted Version.

1.4 SUBMITTALS

A. Product Data: Manufacturer's pump characteristic performance curves with system operating point plotted. Include NPSH curve, variable speed system curves, and parallel pumping curves when applicable. Manufacturer's pump specifications, installation, and start-up instructions. Include electrical characteristics and connection requirements.

B. Contract Close Out Submittals:

1. Operation and Maintenance Data: Include maintenance data, assembly views, lubrication instructions, and replacement parts list. Deliver 2 copies for each type of pump to the Owner's Representative.

1.5 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by UL and NEMA as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 HVAC PUMPS - GENERAL

2.2 IN-LINE PUMPS

A. Manufacturers:

1. ITT Bell & Gossett.

2. Armstrong Pumps Inc.

3. Taco Inc.

B. General: Provide long coupled in-line circulator pumps of sizes, capacities, and characteristics as scheduled on drawings.

C. Type: Horizontal shaft, single stage, vertical split case, oil lubricated, designed for 175 psi working pressure at 225 degrees F operating temperature.

D. Casing: Cast iron, bronze fitted, with flanged pump connections and suction and discharge gauge ports.

E. Impeller: Cast bronze keyed to shaft, hydraulically and dynamically balanced.

F. Bearings: Oil-lubricated bronze.

G. Shaft: Hardened alloy steel with non-ferrous sleeve.

H. Seal: Internally flushed mechanical seal, with cabon seal rotating against a stationary ceramic seat, suitable for continuous operation at 225 degrees F.

I. Drive: Self aligning flexible coupling.

J. Motor: Non-overloading at any point on pump curve, open drip-proof, oil-lubricated journal bearings, resilient mounted construction through 1 HP, rigid mounted 1-1/2 HP and over, built-in thermal overload protection on single phase motors.

1. Motors shall be NEMA High Efficiency with minimum nominal efficiencies complying with ASHRAE Standard 90.1-2010. Efficiencies shall be determined in accordance with NEMA standard MG1.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install in accordance with manufacturer's written instructions with recommended clearances for maintenance.

B. Provide line sized shut-off valves on pump discharge and suction. Provide piping and pump accessories, hangers, supports, anchors, valves, gauges, vibration isolation, and flexible metal connectors on all pumps as required for a complete system.

C. Provide air cock and drain connection on horizontal pump casings.

D. Check alignment, and where necessary, realign shafts of motors and pumps within recommended tolerances by manufacturer. Check and realign in presence of manufacturer's service representative. Check, align, and certify alignment of base mounted pumps prior to start-up.

E. Install in line pumps supported from piping system with access for maintennace.

F. Ensure that pumps are wired properly, grounding has been provided, and motors are rotating in correct direction prior to pump start-up.

G. Lubricate pumps before start-up. Start-up in accordance with manufacturer's written instructions.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and liquid indicators.

D. Valves.

E. Strainers.

F. Filter-driers.

1.2 RELATED REQUIREMENTS

A. Section 23 0716 - HVAC Equipment Insulation.

B. Section 23 0719 - HVAC Piping Insulation.

C. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. AHRI 710 (I-P) - Performance Rating of Liquid-Line Driers; 2009.

B. AHRI 711 (SI) - Performance Rating of Liquid-Line Driers; 2009.

C. AHRI 730 (I-P) - Flow Capacity Rating of Suction-Line Filters and Suction-Line Filter-Driers; 2013.

D. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2013.

E. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants; 2019.

F. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2021.

G. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2018.

H. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2018.

I. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2020.

J. ASME B31.9 - Building Services Piping; 2020.

K. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2020.

L. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

M. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2020.

N. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

O. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018 (Amendent 2019).

1.4 SUBMITTALS

A. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure integrity of system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Filter-Driers:

1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

2. Use a filter-drier on suction line just ahead of compressor.

3. Use sealed filter-driers in lines smaller than 1/2 inch (13 mm) outside diameter.

4. Use sealed filter-driers in low temperature systems.

5. Use sealed filter-driers in systems utilizing hermetic compressors.

6. Use replaceable core filter-driers in lines of 1/2 inch (13 mm) outside diameter or greater.

7. Use replaceable core liquid-line filter-driers in systems utilizing receivers.

8. Use filter-driers for each solenoid valve.

2.2 REGULATORY REQUIREMENTS

A. Comply with ASME B31.9 for installation of piping system.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

2.3 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.

1. Fittings: ASME B16.22 wrought copper.

2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.

B. Copper Tube to 7/8-inch (22 mm) OD: ASTM B88 (ASTM B88M), Type K (A), annealed.

1. Fittings: ASME B16.26 cast copper.

2. Joints: Flared.

C. Pipe Supports and Anchors:

1. Provide hangers and supports that comply with MSS SP-58.

a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Malleable iron adjustable swivel, split ring.

3. Hangers for Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.

4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

5. Wall Support for Pipe Sizes to 3 Inches (75 mm): Cast iron hook.

6. Vertical Support: Steel riser clamp.

7. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

8. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

9. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 REFRIGERANT

A. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) no greater than that allowed by federal code.

B. Refrigerant: R-454B as defined in ASHRAE Std 34.

2.5 MOISTURE AND LIQUID INDICATORS

A. Indicators: Single port type, UL listed, with copper or brass body, flared or soldered ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F (93 degrees C) and maximum working pressure of 500 psi (3450 kPa).

2.6 STRAINERS

A. Manufacturers:

1. Mueller Refrigeration: www.muellerrefrigeration.com/#sle.

B. Straight Line or Angle Line Type:

1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi (2960 kPa).

2.7 FILTER-DRIERS

A. Performance:

1. Flow Capacity - Liquid Line: As indicated in schedule, minimum, rated in accordance with AHRI 710 (I-P) (AHRI 711 (SI)).

2. Flow Capacity - Suction Line: As indicated in schedule, minimum, rated in accordance with AHRI 730 (I-P).

3. Pressure Drop: 2 psi (14 kPa), maximum, when operating at full connected evaporator capacity.

4. Design Working Pressure: 350 psi (2410 kPa), minimum.

B. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

C. Construction: UL listed.

1. Replaceable Core Type: Steel shell with removable cap.

2. Sealed Type: Copper shell.

3. Connections: As specified for applicable pipe type.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.5.

2. Support horizontal piping as indicated.

3. Install hangers to provide minimum 1/2 inch (13 mm) space between finished covering and adjacent work.

4. Place hangers within 12 inches (300 mm) of each horizontal elbow.

5. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.

6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

G. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

H. Provide clearance for installation of insulation and access to valves and fittings.

I. Insulate piping and equipment.

J. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

K. Fully charge completed system with refrigerant after testing.

L. Provide electrical connection to solenoid valves. See Section 26 0583.

3.3 SCHEDULES

A. Hanger Spacing for Copper Tubing.

1. 1/2 inch (13 mm), 5/8 inch (16 mm), and 7/8 inch (22 mm) OD: Maximum span, 5 feet (1500 mm); minimum rod size, 1/4 inch (6.3 mm).

2. 1-1/8 inch (29 mm) OD: Maximum span, 6 feet (1800 mm); minimum rod size, 1/4 inch (6.3 mm).

3. 1-3/8 inch (35 mm) OD: Maximum span, 7 feet (2100 mm); minimum rod size, 3/8 inch (9.5 mm).

4. 1-5/8 inch (41 mm) OD: Maximum span, 8 feet (2400 mm); minimum rod size, 3/8 inch (9.5 mm).

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. By-pass (pot) feeder.

B. Cleaning of piping systems.

C. Chemical feeder equipment.

D. Chemical treatment.

1.2 RELATED REQUIREMENTS

A. Section 01 6000 - Product Requirements: Owner furnished treatment equipment.

B. Section 23 2113 - Hydronic Piping.

C. Section 23 2114 - Hydronic Specialties.

1.3 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.

C. Shop Drawings: Indicate system schematic, equipment locations, and controls schematics, electrical characteristics and connection requirements.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. AmSolv-Amrep, Inc; _____: www.amsolv.com/#sle.

B. GE Water & Process Technologies; _____: www.gewater.com/#sle.

C. Nalco, an Ecolab Company; _____: www.nalco.com/#sle.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.2 BY-PASS (POT) FEEDER

A. Manufacturers:

1. Griswold Controls: www.griswoldcontrols.com/#sle.

2. J. L. Wingert Company: www.jlwingert.com/#sle.

3. Neptune, a brand of the Dover Company: www.neptune1.com/#sle.

B. 2 quart (1.9 L) quick opening cap for working pressure of 175 psi (1200 kPa).

PART 3 EXECUTION

3.1 PREPARATION

A. Systems shall be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.

B. Place terminal control valves in open position during cleaning.

C. Verify that electric power is available and of the correct characteristics.

3.2 CLEANING SEQUENCE

A. Concentration:

1. As recommended by manufacturer.

B. Hot Water Heating Systems:

1. Apply heat while circulating, slowly raising temperature to 160 degrees F (71 degrees C) and maintain for 12 hours minimum.

2. Remove heat and circulate to 100 degrees F (37.8 degrees C) or less; drain systems as quickly as possible and refill with clean water.

3. Circulate for 6 hours at design temperatures, then drain.

4. Refill with clean water and repeat until system cleaner is removed.

C. Remove, clean, and replace strainer screens.

D. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.4 CLOSED SYSTEM TREATMENT

A. Provide one bypass feeder on each system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.

B. Introduce closed system treatment through bypass feeder when required or indicated by test.

C. Provide 3/4 inch (19 mm) water coupon rack around circulating pumps with space for 4 test specimens.

3.5 CLOSEOUT ACTIVITIES

A. Training: Train Owner's personnel on operation and maintenance of chemical treatment system.

1. Provide minimum of two hours of instruction for two people.

2. Have operation and maintenance data prepared and available for review during training.

3. Conduct training using actual equipment after treated system has been put into full operation.

3.6 MAINTENANCE

A. Perform maintenance work using competent and qualified personnel under the supervision and in the direct employ of the equipment manufacturer or original installer.

B. Provide service and maintenance of treatment systems for one year from Date of Substantial Completion.

C. Provide monthly technical service visits to perform field inspections and make water analysis on-site. Detail findings in writing on proper practices, chemical treating requirements, and corrective actions needed. Submit two copies of field service report after each visit.

D. Provide laboratory and technical assistance services during this maintenance period.

E. Provide on-site inspections of equipment during scheduled or emergency shutdown to properly evaluate success of water treatment program, and make recommendations in writing based upon these inspections.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal ductwork.

1.2 RELATED REQUIREMENTS

A. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.

B. Section 23 0713 - Duct Insulation.

C. Section 23 3300 - Air Duct Accessories.

D. Section 23 3700 - Air Outlets and Inlets.

1.3 REFERENCE STANDARDS

A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; 2013.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

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

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

F. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

G. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.4 SUBMITTALS

A. Product Data: Provide data for duct materials.

1.5 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.

B. Duct Fabrication Requirements:

1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.

2. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.

3. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

4. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.

5. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

6. Provide turning vanes of perforated metal with glass fiber insulation when an acoustical lining is required.

7. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

C. Ducts: Galvanized steel, unless otherwise indicated.

D. Low Pressure Supply (Heating Systems): 1/2 inch wg (125 Pa) pressure class, galvanized steel.

E. Return and Relief: 1/2 inch wg (125 Pa) pressure class, galvanized steel.

F. General Exhaust: 1/2 inch wg (125 Pa) pressure class, galvanized steel.

G. Outside Air Intake: 1/2 inch wg (125 Pa) pressure class, galvanized steel.

2.2 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.

2. VOC Content: Not more than 250 g/L, excluding water.

3. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.

C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.3 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.

B. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE (FUND) Handbook - Fundamentals.

C. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

2.4 METAL DUCTS

A. Material Requirements:

1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Flexible Ducts: Two-ply vinyl film supported by helically wound spring steel wire.

1. Pressure Rating: 10 inches wg (2.50 kPa) positive and 1.0 inches wg (250 Pa) negative.

2. Maximum Velocity: 4000 fpm (20.3 m/sec).

3. Temperature Range: Minus 10 degrees F to 160 degrees F (Minus 23 degrees C to 71 degrees C).

C. Flexible Ducts: UL 181, Class 1, UV-inhibited black polymer film supported by helically wound spring steel wire.

1. Pressure Rating: 10 inches wg (2.50 kPa) positive and 0.5 inches wg (175 Pa) negative.

2. Maximum Velocity: 4000 fpm (20.3 m/sec).

3. Temperature Range: Minus 20 degrees F to 175 degrees F (Minus 28 degrees C to 79 degrees C).

PART 3 EXECUTION

3.1 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install products following the manufacturer's instructions.

C. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

D. Duct sizes indicated are inside precise dimensions. For lined ducts, maintain sizes inside lining.

E. Provide openings in ductwork as indicated to accommodate thermometers and controllers. Provide pilot tube openings as indicated for testing of systems, complete with metal can with spring device or screw to insure against air leakage. For openings, insulate ductwork and install insulation material inside a metal ring.

F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

G. Connect terminal units to supply ducts directly or with 1-foot (300 mm) maximum length of flexible duct. Do not use a flexible duct to change direction.

H. Connect diffusers or light troffer boots to low-pressure ducts directly or with 5 feet (1.5 m) maximum length of flexible duct held in place with strap or clamp.

I. At exterior wall louvers, seal duct to louver frame.

J. Duct Insulation: Provide duct insulation. See Section 23 0713.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Combination fire and smoke dampers.

B. Duct access doors.

C. Duct test holes.

D. Fire dampers.

E. Flexible duct connectors.

F. Volume control dampers.

1.2 RELATED REQUIREMENTS

A. Section 23 3100 - HVAC Ducts and Casings.

1.3 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

B. NFPA 92 - Standard for Smoke Control Systems; 2015.

C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

D. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.

E. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.

F. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

PART 2 PRODUCTS

2.1 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:

1. Louvers & Dampers, Inc: www.louvers-dampers.com.

2. Nailor Industries Inc: www.nailor.com.

3. Ruskin Company: www.ruskin.com.

B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.

C. Provide factory sleeve and collar for each damper.

D. Multiple Blade Dampers: Fabricate with 16 gauge, 0.0598 inch (1.52 mm) galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 by 1/2 inch (3.2 by 12.7 mm) plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch (12.7 mm) actuator shaft.

E. Operators: UL listed and labeled spring return electric type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on interior of duct and link to damper operating shaft.

F. Normally Closed Smoke Responsive Fire Dampers: Curtain type, opening by gravity upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure.

G. Electro Thermal Link: Fusible link melting at 165 degrees F (74 degrees C); 120 volts, single phase, 60 Hz; UL listed and labeled.

2.2 DUCT ACCESS DOORS

A. Manufacturers:

1. Acudor Products Inc: www.acudor.com.

2. Elgen Manufacturing: www.elgenmfg.com.

3. Nailor Industries Inc: www.nailor.com.

4. Ruskin Company: www.ruskin.com.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

2.3 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.4 FIRE DAMPERS

A. Manufacturers:

1. Louvers & Dampers, Inc: www.louvers-dampers.com.

2. Nailor Industries Inc: www.nailor.com.

3. Ruskin Company: www.ruskin.com.

B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

C. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1.0 inch (250 Pa) pressure class ducts up to 12 inches (300 mm) in height.

D. Fusible Links: UL 33, separate at 160 degrees F (71 degrees C) with adjustable link straps for combination fire/balancing dampers.

2.5 FLEXIBLE DUCT CONNECTORS

A. Manufacturers:

1. Carlisle HVAC Products: www.carlislehvac.com/#sle.
2. Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.
3. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Flexible Duct Connections: Fabric crimped into metal edging strip.

1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz/sq yd (1.0 kg/sq m).
   a. Net Fabric Width: Approximately 2 inches (50 mm) wide.
2. Metal: 3 inches (75 mm) wide, 24 gauge, 0.0239 inch (0.61 mm) thick galvanized steel.

2.6 VOLUME CONTROL DAMPERS

A. Manufacturers:

1. Louvers & Dampers, Inc: www.louvers-dampers.com.
2. Nailor Industries Inc: www.nailor.com.
3. Ruskin Company: www.ruskin.com.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Single Blade Dampers:

1. Fabricate for duct sizes up to 6 by 30 inch (150 by 760 mm).
2. Blade: 24 gauge, 0.0239 inch (0.61 mm), minimum.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 23 3100 for duct construction and pressure class.

B. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 by 8 inch (200 by 200 mm) size for hand access, size for shoulder access, and as indicated. Provide 4 by 4 inch (100 by 100 mm) for balancing dampers only. Review locations prior to fabrication.

C. Provide duct test holes where indicated and required for testing and balancing purposes.

D. Provide fire dampers and combination fire and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by Authorities Having Jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

E. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.

F. Demonstrate re-setting of fire dampers to Owner's representative.

G. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

H. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

I. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

J. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof Mounted Exhaust Fans.

B. Centrifugal in-line fans.

1.2 RELATED SECTIONS

A. Section 23 3100 - Ductwork.

B. Section 23 3300 - Ductwork Accessories.

1.3 REFERENCES

A. AMCA 99 - Standards Handbook; Air Movement and Control Association International, Inc.; 2003.

B. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating; Air Movement and Control Association International, Inc.; 1999 (ANSI/AMCA 210, same as ANSI/ASHRAE 51).

C. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; Air Movement and Control Association International, Inc.; 1990.

D. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2003.

E. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; National Fire Protection Association; 2004.

F. UL 705 - Power Ventilators; Underwriters Laboratories Inc.; 2004.

1.4 SUBMITTALS

A. Product Data: Manufacturer's catalog sheets, standard schematic drawings, specifications, and installation instructions for each size unit and curb.

1. Provide fan curves with specified operating point clearly plotted.

B. Contract Closeout Submittals:

1. Operation and Maintenance Data: Deliver 2 copies covering the installed products to the Owner's Representative.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Fans shall be licensed to bear the AMCA seal.

2. All electrical components shall be UL listed.

PART 2 PRODUCTS

2.1 ROOF MOUNTED EXHAUST FANS

A. Manufacturers:

1. Greenheck
2. Loren Cook Company.
3. Hartzell Fan Corporation.

B. General: Powered roof exhausters shall be of the electric motor centrifugal fan type, V-belt or direct drive as scheduled on drawings. Fans shall be enclosed in a storm proof aluminum housing, properly braced and stiffened to form a rigid unit.

C. Housing: Fabricate from spun aluminum with bolted and welded construction utilizing corrosion resistant fasteners. Top cap shall be of two piece construction with stainless steel quick release latches to permit access to motor compartment. Provide structural reinforcing members to support fan wheel, motor and bearings, and vibration eliminating devices to prevent transmission of vibration to housing.

D. Fan Assembly:

1. Fan Wheel: Non-overloading backward inclined, spark-resistant centrifugal type, fabricated from aluminum balanced at the factory in accordance with AMCA Standard 204-96.
2. Drive Assembly: Direct or Belt drive as indicated on Drawings.
    a. Direct Drive: Electric motor direct drive.
    b. Belt Drive: Electric motor driven V belt drive, with cast iron or steel pulleys, sized for 150% of rated horsepower at maximum speed.. Provide motor pulley of the variable pitch type, factory set at the design fan RPM at mid-position.
3. Bearings: Heavy duty regreasable ball type in a cast iron pillow block housing designed specifically for air handling equipment and selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.
4. Motor: Heavy duty type with permanently lubricated sealed ball bearings and furnished at the specified voltage, phase, and enclosure. Factory installed wiring shall be in a flexible metal conduit or integral conduit chase.

E. Damper: Automatic self-closing back draft type, with spring actuated return. Fabricate frame and blades from aluminum, with bearings of bronze or nylon. Damper blades shall be coupled together with tie rods at each end and shall have felted edges.

F. Nameplate: Engraved aluminum indicating manufacturer's model number, serial number, and equipment name to match unit tag as identified on drawings.

G. Accessories:

1. Disconnect Switch: Factory installed and wired non-fused disconnect switch, located under fan housing.
2. Birdscreen: Aluminum wire mesh birdscreen on discharge openings.
3. Roof Curb: 12 inch high self-flashing of galvanized steel with integral fiberglass insulation, continuously welded seams, built-in cant strips and curb seal.
4. Damper: Provide automatic air damper in lieu of gravity damper were indicated on drawings. Include line voltage motor drive, power open, spring return.
5. Speed Control: On direct drive models, provide factory installed and wired solid state variable speed controller.

PART 3 EXECUTION

3.1 INSTALLATION

A. General:

1. Install fans and accessories in complete accordance with manufacturer's printed installation instructions and the requirements of the Contract Documents.

2. Provide sheaves required for final air balance.

3. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

    a. Provide automatic air dampers in lieu of gravity damper were indicated on drawings. Include line voltage motor drive, power open, spring return.

B. Roof Mounted Exhaust Fans:

1. Furnish roof curbs to Roofing Contractor for installation with Manufacturer's printed installation instructions.

2. Secure roof exhausters with cadmium plated steel or stainless steel lag screws to roof curb.

3. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Diffusers.

B. Registers/grilles.

1.2 RELATED REQUIREMENTS

A. Section 23 3100 - Ductwork.

B. Section 23 3300 - Ductwork Accessories.

1.3 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; Air Movement and Control Association International, Inc.; 2007.

B. ASHRAE Std 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets; American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.; 2006.

C. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

1.4 SUBMITTALS

A. Product Data: Catalog sheets, diagrams, standard schematic drawings, and installation instructions for each manufactured product.

B. Color Selection: Submit manufacturer's color selection chart to Architect for louver color selection.

C. Schedule of Outlets and Inlets: Indicate type keyed to contract drawings, application, size, airflow, pressure drop, and noise level.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Unless otherwise shown or specified comply with the applicable requirements of the following:

a. SMACNA: Gages of material, fabrication, sealing, and installation shall be in accordance with the SMACNA Manuals.

1 HVAC Duct Construction Standards.

2 Round Industrial Duct Construction Standard.

3 Rectangular Industrial Duct Construction Standard.

b. NFPA: Standards No. 90A, 90B, 91, 96, and 101.

c. UL: Standards No. UL181, UL555, and UL555S.

d. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

e. Test and rate louver performance in accordance with AMCA 500-L.

1.6 MAINTENANCE

A. Special Tools:

1. One bar deflection key for every five supply grilles or diffusers.

2. Two keys or socket wrenches for each type of damper adjustment screw or device on manual damper regulators.

3. One tool for each type and size security fastener.

PART 2 PRODUCTS

2.1 SUPPLY AIR OUTLETS:

A. Manufacturers:

1. Price Industries.

2. Titus.

3. Krueger.

B. Type 'S1':

1. Model: Price SCD.

2. Description: Steel - Square ceiling diffuser with round neck and 4 cones. Back cone shall be one piece seamless construction and corporate a round inlet collar of sufficient length for connecting, rigid or flexible duct.

3. Diffuser shall integrate with all duct sizes shown on plans without affecting face size or appearance.

4. Border: Provide appropriate border to accommodate mounting per ceiling type.

5. Ensure optimal performance to 30% of design air flow in VAV Systems.

6. Finish: B12 White powder coat.

C. Type 'S2':

1. Model: Price SDS.

2. Description: Aluminum - Linear Slot ceiling diffuser with discharge slot spacing and quantity as scheduled on drawings.

3. Diffuser shall have aerodynamically curved "ice-tong" shaped pattern controllers for 180 degree air pattern control and airflow dampering.

4. Border: Heavy extruded aluminum construction with extruded aluminum spaces and mitered end flanges, open ends, flush end caps, or angle end caps as required to suite installation conditions.Continuous length installations shall be factory provided with joiner strips to align continuous slot assemblies.

5. Finish: B12 White powder coat.

6. Plenum:

a. Price Model SDB.

b. Furnish diffuser with linear slot diffuser plenum to match linear slot diffuser, constructed of zinc coated steel with factory applied internal insulation and side inlet configuration.

c. Insulation shall be 1/4" fiber-free foam insulation meeting requirements of UL181/UL723 - ASTM84 flame and smoke spread of less than 25 & smoke generation of less than 50.

2.2 RETURN AIR INLETS:

A. Manufacturers:

1. Price Industries.

2. Titus.

3. Krueger.

B. Type 'R1':

1. Model: Price Series 81.

2. Description: Aluminum 1/2"x1/2"x1" grids (egg crate core) with extruded aluminum border. Sized per schedule on drawings.

3. Border: Type TSF for lay-in installation, Type SF for surface mount. Panel mounting shall not be allowed.

4. Finish: B12 white powder coat.

5. Provide with factory fabricated square to round adapter for connection to ductwork.

2.3 EXHAUST AIR INLETS:

A. Manufacturers:

1. Price Industries.

2. Titus.

3. Krueger.

B. Type 'E1':

1. Model: Price Series 81.

2. Description: Aluminum 1/2"x1/2"x1" grids (egg crate core) with extruded aluminum border. Sized per schedule on drawings.

3. Border: Type TB for lay-in installation, Type SF for surface mount. Panel mounting shall not be allowed.

4. Finish: B12 white powder coat.

5. Provide with factory fabricated square to round adapter for connection to ductwork. Round diameter as scheduled on drawings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Unless otherwise specified, install the Work of this Section in accordance with manufacturer's printed installation instructions and the appropriate SMACNA Manual.

B. Coordination: Coordinate location of outlets and inlets with other trades. Make necessary minor adjustments in position to conform with architectural features, symmetry, sprinkler/smoke heads, and lighting arrangement.

1. Locate outlets and inlets to conform to reflected ceiling plans.

2. Arrange and locate duct taps to accomodate proper placement of outlets and inlets.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Manufactured double wall chimneys for fuel fired equipment.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

A. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2009a.

B. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2003.

C. ASTM A 1011/A 1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low Alloy, High-Strength Low-Alloy With Improved Formability, and Ultra-High Strength; 2009b.

D. NFPA 54 - National Fuel Gas Code; National Fire Protection Association; 2009.

E. NFPA 82 - Standard on Incinerators and Waste and Linen Handling Systems and Equipment; National Fire Protection Association; 2009.

F. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances; National Fire Protection Association; 2010.

G. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

H. UL 103 - Factory-Built Chimneys for Residential Type and Building Heating Appliances; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

I. UL 441 - Standard for Gas Vents; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

J. UL 641 - Type L Low Temperature Venting Systems; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

K. UL 959 - Medium Heat Appliance Factory Built Chimneys; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 DEFINITIONS

A. Breeching: Vent Connector.

B. Chimney: Primarily vertical shaft enclosing at least one vent for conducting flue gases outdoors.

C. Smoke Pipe: Round, single wall vent connector.

D. Vent: That portion of a venting system designed to convey flue gases directly outdoors from a vent connector or from an appliance when a vent connector is not used.

E. Vent Connector: That part of a venting system that conducts the flue gases from the flue collar of an appliance to a chimney or vent, and may include a draft control device.

1.5 DESIGN REQUIREMENTS

A. Factory built vents and chimneys used for venting natural draft appliances shall comply with NFPA 211 and be UL listed and labeled.

1.6 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating factory built chimneys, including dimensional details of components and flue caps, dimensions and weights, electrical characteristics and connection requirements.

C. Shop Drawings: Indicate general construction, dimensions, weights, support and layout of breechings. Submit layout drawings indicating plan view and elevations where factory built units are used.

D. Manufacturer's Instructions: Include installation instructions, and indicate assembly, support details, and connection requirements.

E. Manufacturer's Certificate: Certify that refractory lined metal stacks meet or exceed specified requirements.

1.7 QUALITY ASSURANCE

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

1.8 REGULATORY REQUIREMENTS

A. Conform to applicable code for installation of natural gas burning appliances and equipment.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. American Metal Products/Commercial Products Group

B. Metal-Fab, Inc

C. Selkirk, Inc; Model PS

2.2 DOUBLE WALL METAL STACKS

A. Provide double wall metal stacks, tested to UL 103 and UL listed, for use with building heating equipment, in compliance with NFPA 211.

B. Fabricate with 1 inch minimum air space between walls. Construct inner jacket of 20 gage ASTM A 666, Type 304 stainless steel. Construct outer jacket of aluminum coated steel 24 gage for sizes 10 inches to 24 inches and 20 gage for sizes 28 inches to 48 inches.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NFPA 54.

C. Provide all modular straight sections, fittings, supports, guides, expansion joints, guy sections, guy tensioners, roof thimbles, roof flashings, storm collars and stack cap terminations as required to provide a complete system per the manufacturer's installation instructions.

D. The vertical stack termination shall be no less than two feet above any portion of the building within ten feet of the stack penetration (see NFPA-211).

E. Assemble and install stack sections in accordance with NFPA 82, industry practices, and in compliance with UL listing. Join sections with acid-resistant joint cement. Connect base section to foundation using anchor lugs.

F. Level and plumb chimney and stacks.

G. Clean breechings, chimneys, and stacks during installation, removing dust and debris.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Manufactured units.

B. Boiler construction.

C. Boiler trim.

D. Fuel burning system.

E. Factory installed controls.

F. Magnetic filters.

1.2 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

B. Section 23 0913 - Instrumentation and Control Devices for HVAC.

C. Section 23 2114 - Hydronic Specialties.

D. Section 23 2123 - Hydronic Pumps.

E. Section 23 2500 - HVAC Water Treatment.

F. Section 23 5100 - Breechings, Chimneys, and Stacks.

G. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); Current Edition.

B. ANSI Z21.13 - American National Standard for Gas-Fired Low Pressure Steam and Hot Water Boilers; 2017, with Errata (2018).

C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks; 2020, with Errata and Amendments (2021).

E. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.

F. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2021.

G. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2021.

H. NBBI Manufacturer and Repair Directory - The National Board of Boiler and Pressure Vessel Inspectors (NBBI); Current Edition.

I. NFPA 54 - National Fuel Gas Code; 2015.

J. SCAQMD 1146.1 - Emissions of Oxides of Nitrogen from Small Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters; 1990 (Amended 2018).

1.4 SUBMITTALS

A. Product Data: Provide data indicating general assembly, components, controls, safety controls, and wiring diagrams with electrical characteristics and connection requirements, and service connections.

B. Manufacturer's Installation Instructions: Indicate assembly, support details, connection requirements, and include start up instructions.

C. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, cleaning procedures, replacement parts list, and maintenance and repair data.

D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 WARRANTY

A. Provide a five year warranty to include coverage for heat exchanger.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

A. Factory assembled, factory fire-tested, self-contained, readily transported unit ready for automatic operation except for connection of water, fuel, electrical, and vent services.

B. Unit: Metal membrane wall, water or fire tube, condensing boiler on integral structural steel frame base with integral fuel burning system, firing controls, boiler trim, insulation, and removable jacket, suitable for indoor application.

2.2 BOILER CONSTRUCTION

A. Comply with the minimum requirements of ASME BPVC-IV and ANSI Z21.13 for construction of boilers.

B. Assembly to bear the ASME "H" stamp and comply with the efficiency requirements of the latest edition of ASHRAE Std 90.1 I-P.

C. Required Directory Listings:

1. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); current edition at www.ahrinet.org.

2. NBBI Manufacturer and Repair Directory - The National Board of Boiler and Pressure Vessel Inspectors (NBBI); current edition at www.nationalboard.org.

D. Heat Exchanger: Construct with materials that are impervious to corrosion where subject to contact with corrosive condensables.

E. Provide adequate tappings, observation ports, removable panels, and access doors for entry, cleaning, and inspection.

F. Insulate casing with insulation material, protected and covered by heavy-gauge metal jacket.

G. Factory apply boiler base and other components, that are subject to corrosion, with durable, acrylic, powder coated, painted, or weather-proofed finish.

2.3 BOILER TRIM

A. ASME rated pressure relief valve.

B. Flow switch.

C. Electronic Low Water Cut-off: Complete with test light and manual reset button to automatically prevent firing operation whenever boiler water falls below safe level.

D. Temperature and pressure gauge.

E. Pressure Switches:

1. High gas pressure.

2. Low gas pressure.

3. Air pressure.

F. Manual reset high limit.

G. Boiler Pump (where required by boiler design):

1. Primary pump, factory supplied and sized for field installation to ensure minimum, continuous circulation through boiler.

2. Where pump is not provided by boiler manufacturer, provide pump in accordance with boiler manufacturer's recommendations.

3. Pump time delay.

2.4 FUEL BURNING SYSTEM

A. Provide forced draft automatic burner or pulse combustion, integral to boiler, designed to burn natural gas, and maintain fuel-air ratios automatically.

1. Blower Design: Statically and dynamically balanced to supply combustion air; direct connected to motor.

2. Forced Draft Design: Mixes combustion air and gas to achieve 90 percent combustion efficiency.

3. Pulse Combustion Design: Self-aspirating, not requiring blower for combustion.

4. Combustion Air Filter: Protects fuel burning system from debris.

B. Gas Train: Plug valve, safety gas valve, gas-air ratio control valve, and pressure regulator controls air and gas mixture.

C. Emission of Oxides of Nitrogen Requirements: Comply with SCAQMD 1146.1 for natural gas fired system, as applicable.

D. Intakes: Combustion air intake capable of accepting free mechanical room air or direct outside air through a sealed intake pipe.

2.5 FACTORY INSTALLED CONTROLS

A. Option for internal or external (0-10) VDC control.

B. Temperature Controls:

1. Automatic reset type to control fuel burning system on-off and firing rate to maintain temperature.

2. Manual reset type to control fuel burning system to prevent boiler water temperature from exceeding safe system water temperature.

3. Low-fire start time delay relay.

C. Electronic PI setpoint/modulation control system.

D. Microprocessor-based, fuel/air mixing controls.

E. BAS, SCADA, or other Integrated Automation Link: ASHRAE Std 135 BACnet MS/TP.

1. External Point Mapping: Provide mapping table for each parameter included in the local visual interface with software-toggle flag to allow reduced mapping of available points.

2.6 MAGNETIC FILTERS

A. Description: ASME BPVC-VIII-1 compliant, packaged oxide filtration assembly configured to remove dissolved ferrous metals from hydronic systems.

B. In-line Filter Assembly:

1. Magnetic belt surrounded by stainless steel vessel and nonferrous casing.

2. Provide filter assembly with automatic air vent and EPDM flange gaskets.

3. Flange Connections: 2 inches (50 mm, DN), ASME B16.5 Class 150.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install boiler and provide connection of natural gas service in accordance with requirements of NFPA 54 and applicable codes.

C. Install boiler on concrete housekeeping base, sized minimum of 4 inches (100 mm) larger than boiler base in accordance with Section 03 3000.

D. Coordinate factory installed controls with Section 23 0913.

E. Coordinate provisions for water treatment in accordance with Section 23 2500.

F. Pipe relief valves to nearest floor drain.

G. Pipe cooled condensate produced by the combustion process from the boiler condensate connection and/or flue stack with suitable piping material to neutralizer prior to discharging into nearest floor drain.

H. Install primary boiler pump in accordance with Section 23 2123.

I. Provide piping connection and accessories in accordance with Section 23 2114.

J. Provide for connection to electrical service in accordance with Section 26 0583.

3.2 CLOSEOUT ACTIVITIES

A. Training: Train Owner's personnel on operation and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Energy recovery ventilators.

1.2 RELATED REQUIREMENTS

A. Section 23 0548 - Vibration and Seismic Controls for HVAC.

B. Section 23 0923 - Direct-Digital Control System for HVAC.

C. Section 26 0583 - Wiring Connections.

1.3 REFERENCE STANDARDS

A. AHRI 1060 (I-P) - Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment; 2018.

B. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2012, with 2015 amendments.

C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks; 2020, with Errata and Amendments (2021).

E. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2019.

F. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

G. Modbus (PS) - The Modbus Organization Communications Protocol.; Latest Update.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

J. UL (DIR) - Online Certifications Directory; Current Edition.

K. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.4 SUBMITTALS

A. Product Data: Manufacturer's installation instructions, product data, and engineering calculations.

B. Closeout Submittals: Submit manufacturer's operation and maintenance instructions.

1.5 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Store products in manufacturer's unopened packaging until ready for installation.

1.6 WARRANTY

A. Manufacturer Warranty: Provide 1-year manufacturer warranty for equipment including parts, materials, workmanship, and operation commencing on date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Greenheck: www.greenheck.com/#sle.

B. LG Electronics U.S.A., Inc: www.lghvac.com/#sle.

C. RenewAire: www.renewaire.com/#sle.

2.2 ENERGY RECOVERY VENTILATOR

A. ERV Equipment Construction Requirements:

1. Energy Recovery Exchanger Type: Membrane plate.

2. Supply and Return Duct Connection Orientation: As indicated on drawings.

3. Casing and Frame:

a. Frame: Galvanized steel body or welded extruded aluminum tubular frame capable of supporting components and casings including integral base lifting holes.

b. Double Wall Panels: Minimum of 18 gauge, 0.040 inch (1.02 mm) galvanized steel.

c. Doors: Construct doors of same construction and thickness as wall panels. Include p-shaped extruded neoprene gasket, prop rod, chain with spring, exterior handle, and interior 3-point latching device. Label each door to identify equipment located within.

d. Insulation Requirements:

1 Mold Resistance: "Pass" when tested in accordance with ASTM C1338.

2 Fungal Resistance: No growth when tested in accordance with ASTM G21.

3 Bacteria Resistance: No growth when tested in accordance with UL 181.

4 Flame spread index of 25 or less and maximum smoke developed index of 50.

e. Isolation and Sealing: Form continuous, thermally isolated, weathertight seal between inner wall of panels and structural framing with closed cell PVC foam gasketing and seal seams to prevent job site caulking.

f. Access Panels: Provide access to components through a large, tightly sealed and easily removable hinged or screwed access panel.

g. Finish: Baked powder paint over weather-protected, corrosion-resistant assembly.

h. Nameplate: Permanent name plate listing manufacturer, model number, serial number, voltage with tolerance, and amp ratings mounted inside door near electrical panel.

4. Supply and Exhaust Fans:

   a. Provide separate non-overloading, statically and dynamically balanced, draw-through, forward curved centrifugal fan or fan-array for each air stream.

   b. Fan Motor: Constant Speed, high efficiency, load matched, belt-driven, open drip proof, thermal overload protected TEFC motor with variable-sheave belt drive, and adjustable-removable motor-slide base. Size drives to 150 percent of load, minimum.

   c. Belt Guards: Full sized, hinged, painted with high-visibility safety color, and accessible with standard tools.

   d. Motor Bearings: Permanently lubricated sealed ball bearings rated for not less than 200,000 hours of operation with accessible greased fittings.

5. Filter Sections:

   a. Outdoor-Intake and Exhaust Sides: 2 inch (50 mm) thick, pleated, MERV 13 filters, ASHRAE Std 52.2.

   b. Filter Racks: Bolt-on rack constructed of aluminum with minimum size of 1/12 inch (2 mm) thick. Include hinged side access door and snap fasteners.

6. Vibration Isolation: Provide corrosion-resistant vibration isolation products for internal motors and other revolving parts. See Section 23 0548.

7. Electrical:

   a. 120 VAC, 1-phase with single-point power connection to nonfused main disconnect interlocked with control panel and other components.

   b. Install internal wiring in accordance with NFPA 70 within flexible, liquid tight steel conduit.

8. Controls and Local Control Panel:

   a. Unit Controls: Factory supplied DDC with sensors, limit switches, and frost control.

   b. Provide fused disconnect within local control panel with power supplies, transformers, terminal strip or terminal blocks for interface of field installed components.

   c. Service Status: Provide both local and remote indication of sensor readings and status of safeties and other status items including power on, wheel-rotation alarm, outside-air loaded filter and exhaust-air loaded filter.

   d. Provide temperature, humidity, dewpoint temperature, CO2, and wheel rotation sensors.

   e. Freeze Protection Thermostat: Provide and configure to stop unit when outdoor air intake temperature drops below 38 degrees F (3.3 degrees C), adjustable.

9. BAS, SCADA, or other Integrated Automation Link: ASHRAE Std 135 BACnet MS/TP.

10. Configuration: Adjust listed requirements in conformance with ASHRAE Std 90.1 I-P.

11. Certification: AHRI 1060 (I-P) labeled, include copy of published ratings for operating conditions.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that structure is ready for installation including openings, ductwork, mechanical utilities, and electrical utilities.

3.2 INSTALLATION

A. Install equipment in accordance with manufacturer's written installation instructions.

B. Do not obstruct maintenance access to equipment piping, electrical conduit, or any other utility.

C. Vibration Isolation: Provide corrosion-resistant equipment isolation products; see Section 23 0548.

D. Electrical: Provide equipment raceway, wiring, and cables; see Section 26 0583.

E. Coordinate installation and fire alarm system interface of system compatible duct-mounted smoke detectors and other appurtenances following NFPA 90A guidelines.

F. Start system and adjust controls and equipment for satisfactory operation.

G. Coordinate hardwired or software interfacing links to enable coordinate as minimum start-stop, occupied, unoccupied functions as well as specific schedules and setpoints functions with other DDC controls onboard airside systems serving common spaces; see Section 23 0923.

3.3 CLOSEOUT ACTIVITIES

A. Training: Train Owner's personnel on operation and maintenance of system.

1. Training Reference: Operation and maintenance manual and additional training materials as required.

2. Provide minimum of two hours of training.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air handling units.

1.2 RELATED REQUIREMENTS

A. Section 23 3100 - Ductwork.

B. Section 23 3300 - Ductwork Accessories.

1.3 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; American Bearing Manufacturers Association, Inc.; 1990 (Reapproved 2000).

B. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings; American Bearing Manufacturers Association, Inc.; 1990 (Reapproved 1999).

C. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; Air Movement and Control Association International, Inc.; 2008.

D. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; Air Movement and Control Association International, Inc.; 2006.

E. ARI 260 - Standard for Sound Rating of Ducted Air Moving and Conditioning Equipment.

F. AHRI 410 - Standard for Forced-Circulation Air-Cooling and Air-Heating Coils; Air-Conditioning, Heating, and Refrigeration Institute; 2001 (R2005) .

G. AHRI 430 - Standard for Central-Station Air-Handling Units; Air-Conditioning, Heating, and Refrigeration Institute; 2009.

H. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2009, Revision 1 - 2010.

I. NFPA 90 A & B - Installation of Air Conditioning and Ventilation Systems and Installation of Warm Air Heating and Air Conditioning Systems.

J. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

K. UL 900 - Standard for Air Filter Units; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements. Computer generated fan curves for each air handling unit shall be submitted with specific design operating point noted. A computer generated psychometric chart shall be submitted for each cooling coil with design points and final operating point clearly noted. Sound data for discharge, radiated and return positions shall be submitted by octave band for each unit.

B. Product Data:

1. Provide literature that indicates dimensions, weights, capacities, ratings, fan performance, finishes of materials, electrical characteristics, and connection requirements.

2. Provide data of filter media, filter performance data, filter assembly, and filter frames.

3. Provide manufacturer's installation instructions.

C. Contract Closeout Submittals:

1. Operation and Maintenance Data: Deliver 2 copies, covering the installed products to the Owner's Representative.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 3300 - Product Requirements, for additional provisions.

2. Extra Fan Belts: One set for each unit.

3. Extra Filters: One set for each unit.

4. Box and label filters, label belts. Store at site where directed by Owner's Representative.

1.5 QUALITY ASSURANCE

A. NFPA Compliance

1. Comply with applicable provisions NPFA 70 pertaining to construction and installation of electrically operated components of packaged air handling units.

B. Flame-Smoke Ratings

1. Except as otherwise indicated, provide air handling unit thermal insulation with flame-spread rating of 25 or less, fuel-contributed of 50 or less, and smoke developed rating of 50 or less.

C. AMCA Standards

1. Comply with Air Movement and Control Association Standards as applicable to testing and rating fans, and testing louvers, dampers, and shutters.

D. Damper Air Leakage Rate

1. Except where more stringent limitation is indicated, provide dampers with leakage limited to 6 CFM per square foot at 4" static pressure differential.

E. SMACNA Compliance

1. Comply with Sheet Metal and Air Conditioning Contractors National Association ductwork construction standards as applicable to air handling units.

F. Industry Standards

1. Except as otherwise indicated, comply with ASHRAE recommendations pertaining to packaged air handling units.

G. ARI Certification

1. Provide central station packaged air handling units which comply with Air Conditioning and Refrigeration Institute Standard 430 and display ARI's certification symbols.

H. UL Compliance

1. Provide electric components for air handling units which have been listed and labeled by Underwriters' Laboratories.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

B. Units shall ship fully assembled up to practical shipping and rigging limitations. Units not shipped fully assembled shall have tags and airflow arrows on each section to indicate location and orientation in direction of airflow. Each section shall have lifting lugs or shipping skid to allow for field rigging and final placement of section.

C. Deliver units to jobsite with fan motor(s), sheave(s), and belt(s) completely assembled and mounted in units.

1.7 WARRANTY

A. Provide a full parts warranty for one year from substantial completion or 18 months from shipment, whichever occurs first.

1.8 START-UP AND OPERATING REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, condensate properly trapped, piping connections verified and leak-tested, belts aligned and tensioned, all shipping braces removed, bearing set screws torqued, and fan has been test run under observation.

PART 2 PRODUCTS

2.1 AIR HANDLING UNITS

A. Manufacturers:

1. Daikin Applied.

2. The Trane Company.

3. York International Corporation.

B. GENERAL:

1. Configuration: Fabricate as detailed on drawings.

2. Performance: Conform to AHRI 430. See schedules on prints. (NOTE: above does not apply to fan array)

C. UNIT CONSTRUCTION

1. Fabricate unit with heavy gauge channel posts and panels secured with mechanical fasteners. All panels, access doors, and ship sections shall be sealed with permanently applied bulb-type gasket. Shipped loose gasketing is not allowed.

2. Panels and access doors shall be constructed as a 2-inch nominal thick; thermal broke double wall assembly, injected with foam insulation with an R-value of not less than R-13.

a. The inner liner shall be constructed of G90 galvanized steel.

b. The outer panel shall be constructed of G90 galvanized steel.

c. The floor plate shall be constructed as specified for the inner liner.

d. Unit will be furnished with solid inner liners.

3. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, maximum 5 inches of positive or 6 inches of negative static pressure. Deflection shall be measured at the panel midpoint.

4. The casing leakage rate shall not exceed 0.50 cfm per square foot of casing surface area at design static pressure up to a maximum of +5" w.c. in positive pressure sections and -6" w.c. in negative pressure sections (.0025 m3/s per square meter of cabinet area at 1.24 kPa static pressure)

5. Module to module field assembly shall be accomplished with an overlapping, full perimeter internal splice joint that is sealed with bulb type gasketing on both mating modules to minimize on-site labor and meet indoor air quality standards.

6. Access doors shall be flush mounted to cabinetry, with minimum of two six inch long stainless steel piano-type hinges, latch and full size handle assembly. Access doors shall swing outward for unit sections under negative pressure. Access doors on positive pressure sections, shall have a secondary latch to relieve pressure and prevent injury upon access.

D. FAN ASSEMBLIES

1. Acceptable fan assembly shall be a single width, single inlet, class II, direct-drive type plenum fan dynamically balanced as an assembly, as shown in schedule. Maximum fan RPM shall be below first critical fan speed. Fan assemblies shall be dynamically balanced by the manufacturer on all three planes. Provide access to motor and fan assembly through hinged access door.

2. Fan and motor shall be mounted internally on a steel base. Factory mount motor on slide base that can be slid out the side of the unit if removal is required. Provide access to motor, drive, and bearings through hinged access door. Fan and motor assembly shall be mounted on 2" deflection spring vibration type isolators inside cabinetry.

E. BEARINGS, SHAFTS, AND DRIVES

1. Bearings: Basic load rating computed in accordance with AFBMA - ANSI Standards. The bearings shall be provided on the motor with the fan wheel mounted directly on the motor shaft, AMCA arrangement 4.

2. Shafts shall be solid, hot rolled steel, ground and polished, keyed to shaft, and protectively coated with lubricating oil. Hollow shafts are not acceptable.

3. The fan wheel shall be direct coupled to the motor shaft. The wheel width shall be determined by motor speed and fan performance characteristics.

F. ELECTRICAL

1. Fan motors shall be manufacturer provided and installed, Open Drip Proof, premium efficiency (meets or exceeds EPAct requirements), 1160 RPM, single speed, 200V / 60HZ / 3P. Complete electrical characteristics for each fan motor shall be as shown in schedule.

2. The air handler(s) shall be ETL and ETL-Canada listed by Intertek Testing Services, Inc. Units shall conform to bi-national standard ANSI/UL Standard 1995/CSA Standard C22.2 No. 236.

3. Wiring Termination: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclosed terminal lugs in terminal box sized to NFPA 70.

4. Manufacturer shall provide ASHRAE 90.1 Energy Efficiency equation details for individual equipment to assist Building Engineer for calculating system compliance.

5. Air handler manufacturer shall provide, mount and wire ABB variable speed drive with electrical characteristics such as indicated on project schedule and shown on manufacturer's data sheets.

G. HEATING COILS

1. Certification: Acceptable water heating, and refrigerant coils shall be certified in accordance with AHRI Standard 410 and bear the AHRI label. Coils exceeding the scope of the manufacturer's certification and/or the range of AHRI's standard rating conditions will be considered provided the manufacturer is a current member of the AHRI Forced Circulation Air-Cooling and Air-Heating Coils certification programs and that the coils have been rated in accordance with AHRI Standard 410. Manufacturer must be ISO 9002 certified.

2. Water heating coil shall be provided. Provide access to coil(s) for service and cleaning. Enclose coil headers and return bends fully within unit casing. Unit shall be provided with coil connections that extend a minimum of 5" beyond unit casing for ease of installation. Drain and vent connections shall be provided exterior to unit casing. Coil connections must be factory sealed with grommets on interior and exterior panel liners to minimize air leakage and condensation inside panel assembly. If not factory packaged, Contractor must supply all coil connection grommets and sleeves. Coils shall be removable through side and/or top panels of unit without the need to remove and disassemble the entire section from the unit.

   a. Headers shall consist of seamless copper tubing to assure compatibility with primary surface. Headers to have intruded tube holes to provide maximum brazing surface for tube to header joint, strength, and inherent flexibility. Header diameter should vary with fluid flow requirements.

   b. Fins shall have a minimum thickness of 0.0075 inch aluminum plate construction. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates. Bare copper tubes shall not be visible between fins.

   c. Coil tubes shall be 5/8 inch OD seamless copper, 0.020 inch nominal tube wall thickness, expanded into fins, brazed at joints.

   d. Coil connections shall be carbon steel, threaded connection. Connection size to be determined by manufacturer based upon the most efficient coil circuiting. Vent and drain fittings shall be furnished on the connections, exterior to the air handler. Vent connections provided at the highest point to assure proper venting. Drain connections shall be provided at the lowest point to insure complete drainage and prevent freeze-up.

   e. Coil shall be furnished as an uncased galvanized steel to allow for thermal movement and slide into a pitched track for fluid drainage.

3. Direct expansion refrigerant heating/cooling coil shall be provided where required per contract drawings. Provide access to coil(s) for service and cleaning. Enclose coil headers and return bends fully within unit casing. Unit shall be provided with coil connections that extend a minimum of 3" beyond unit casing for ease of installation. Coil connections must be factory sealed with grommets on interior and exterior panel liners to minimize air leakage and condensation inside panel assembly. If not factory packaged, Contractor must supply all coil connection grommets and sleeves. Coils shall be removable through side and/or top panels of unit without the need to remove and disassemble the entire section from the unit.

   a. Sweat type copper suction headers shall be provided.

   b. Fins shall have a minimum thickness of 0.0075 inch aluminum plate construction. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates. Bare copper tubes shall not be visible between fins.

c. Coil tubes shall be 5/8 inch OD seamless copper, 0.020 inch nominal tube wall thickness, expanded into fins on 1 1/2-inch centers, brazed at joints.

d. Sweat type copper suction connections located at the bottom of the suction headers for gravity oil drainage. Coils shall be uniformly circuited in a counterflow manner for either single circuit, row, face, interlaced, or interlaced face split capacity reduction as shown on unit schedule. Pressure type liquid distributors used. Coils shall be tested with 315 pounds air pressure under warm water, and suitable for 250 psig working pressure.

e. Coil casing shall be a formed channel frame of galvanized steel.

H. FILTERS

1. Furnish combination filter section with 2-inch pleated MERV 8 flat pre-filter and 4-inch Varicel II MH cartridge MERV 13 final filter. Provide side loading and removal of filters.

2. Filter media shall be UL 900 listed, Class I or Class II.

3. Filter Magnehelic gauge(s) shall be furnished and mounted by equipment manufacturer.

I. ADDITIONAL SECTIONS

1. Access section shall be provided for access between components.

2. Economizer section shall be provided with end outside air opening and top return air opening and top exhaust air opening without (opening only) or with parallel low leak airfoil damper blades. If furnished with dampers, they shall be hollow core galvanized steel airfoil blades, fully gasketed and have continuous vinyl seals between damper blades in a galvanized steel frame. Dampers shall have stainless steel jamb seals along end of dampers. Linkage and ABS plastic end caps shall be provided when return and outside air dampers sized for full airflow. Return and outside air dampers of different sizes or very large dampers and exhaust dampers must be driven separately. Damper Leakage: Leakage rate shall be less than two tenths of one percent leakage at 2 inches static pressure differential. Leakage rate tested in accordance with AMCA Standard 500.

3. Energy recovery wheel shall be constructed of corrugated synthetic fibrous media, with a desiccant intimately bound and uniformly and permanently dispersed throughout the matrix structure of the media. Rotors with desiccants coated bonded, or synthesized onto the media are not acceptable due to delaminating or erosion of the desiccant material. Media shall be synthetic to provide corrosion resistance and resistance against attack from laboratory chemicals present in pharmaceutical, hospital, etc. environments as well as attack from external outdoor air conditions. Coated aluminum is not acceptable. Face flatness of the wheel shall be maximized in order to minimize wear on inner seal surfaces and to minimize cross leakage. Rotor shall be constructed of alternating layers of flat and corrugated media. Wheel layers should be uniform in construction forming uniform aperture sizes for airflow. Wheel construction shall be fluted or formed honeycomb geometry so as to eliminate internal wheel bypass. Wheel layers that can be separated or spread apart by airflow are unacceptable due to the possibility of channeling and performance degradation. The minimum acceptable performance shall be as specified in the unit schedule. Desiccant Material: The desiccant material shall be a molecular sieve, and specifically a 4A or smaller molecular sieve to minimize cross contamination. Wheel Media Support System: The wheel frames shall consist of evenly spaced steel spokes, galvanized steel outer band and rigid center hub. The wheel construction should allow for post fabrication wheel alignment. Wheel Seals: The wheel seals shall be full contact nylon brush seals or equivalent. Seals should be easily adjustable. Wheel cassette: Cassettes shall be fabricated of heavy duty reinforced galvanized steel or welded structural box tubing. Cassettes shall have a built in adjustable purge section minimizing cross contamination of supply air as shown on unit schedule. Bearings shall be inboard, zero maintenance, permanently sealed roller bearings, or alternatively, external flanged or pillow block bearings. Drive systems shall consist of fractional horsepower AC drive motors with multi-link drive belts. Face and bypass dampers shall be furnished as shown on unit schedule and drawings. Certification: The wheel shall be AHRI certified by the energy recovery wheel supplier to AHRI Standard 1060 and must bear the AHRI certification stamp. Private independent testing performed "in accordance with" various standards is not a substitute for AHRI certification and shall not be accepted. The wheel shall be listed or recognized by UL or equivalent.

J. Accessories:

1. Factory mounted and wired VFD with bypass including the following:

a. 4-20mA or 0-10 V speed signal.

b. Power, pending fault, and fault LED indicator lights.

c. LCD display and keypad.

d. English language electrical values, parameters, self test, faults and diagnostics.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in strict accordance with manufacturer's written instructions.

B. Install flexible duct connections between inlet and discharge ductwork and air handling unit sections. Ensure that metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

C. Install assembled unit on vibration isolators. Install isolated fans with resilient mountings and flexible electrical leads. Install restraining snubbers as required. Adjust snubbers to prevent tension in flexible connectors when fan is operating.

D. Make connections to coils with unions or flanges.

E. Hydronic Coils:

1. Hydronic Coils: Connect water supply to leaving air side of coil (counterflow arrangement).

2. Provide shut-off valve on supply line and balancing valve with memory stop on return line.

3. Locate water supply at bottom of supply header and return water connection at top.

4. Provide manual air vents at high points complete with stop valve.

5. Ensure water coils are drainable and provide drain connection at low points.

F. Insulate coil headers located outside air flow as specified for piping. Refer to Section 23 0719.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Finned tube radiation.

B. Fan-coil units.

C. Unit ventilators.

1.2 RELATED REQUIREMENTS

A. Section 23 2113 - Hydronic Piping.

B. Section 23 2114 - Hydronic Specialties.

1.3 SUBMITTALS

A. Product Data: Provide typical catalog of information including arrangements.

B. Shop Drawings:

1. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.

C. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 FINNED TUBE RADIATION

A. Manufacturers:

1. Runtal North America, Inc.

2. Slant/Fin Corporation.

3. Sterling Hydronics/Mestek Technology, Inc.

4. Substitutions: See Section 01 6000 - Product Requirements.

B. General: Provide steel double panel radiators of the lengths and in locations as indicated, and of capacities, style and having accessories as scheduled. The double heating panel radiation shall be of one-piece all-welded steel construction, consisting of a pair of flattened water tube panels welded to headers at each end. Welded to the inside of each panel shall be steel corrugated fins to increase the convective output of the radiator. The fins shall start at no less than 3" from the end of the radiator, and shall have no less than 32 fins per foot. A third set of fins shall be added to the backside of the radiator for maximum convective output. The radiators shall include an integral heavy gauge (0.09" minimum) all-welded perforated top grille, which will cover the top of all of the finned areas.

C. Pressure Ratings: Working pressure-56 PSI maximum, Test Pressure-74 PSI maximum.

D. Finish: The panel radiation shall be cleaned and phosphatized in preparation for the powder coat finish. The radiation is then finish painted with a gloss powder coat finish, for a total paint thickness of 2-3 mils (0.002" – 0.003").

2.2 FAN-COIL UNITS / BLOWER COIL UNITS

A. Manufacturers:

1. Daikin Applied: www.daikinapplied.com/#sle.

2. Trane Inc: www.trane.com/#sle.

3. Enviro-Tec.

4. Substitutions: See Section 01 6000 - Product Requirements.

B. Coils: Evenly spaced aluminum fins mechanically bonded to copper tubes, designed for 200 psi (1380 kPa) and 220 degrees F (104 degrees C). Provide drain pan under cooling coil, easily removable for cleaning, with drain connection.

C. Cabinet: 0.0598 inch (1.5 mm) steel with exposed corners and edges rounded, easily removed panels, glass fiber insulation and integral air outlet.

D. Finish: Factory apply baked primer coat on visible surfaces of enclosure or cabinet.

E. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven.

F. Motor: Tap wound multiple speed permanent split capacitor with sleeve bearings, resiliently mounted.

G. Control: Multiple speed switch, factory wired, located in cabinet.

H. Filter: Easily removed 1 inch (25 mm) thick glass fiber throw-away type, located to filter air before coil.

I. Mixing Dampers: Where indicated, mixing sections with dampers. Refer to Section 23 0993 for operating sequence.

J. Wall Louvers: Anodized aluminum wall intake box and louvers removable from frame with 1/2 inch (13 mm) square mesh galvanized screen in back of louver.

2.3 UNIT VENTILATORS

A. Manufacturers:

1. Carrier Corporation: www.carrier.com/#sle.

2. Daikin Applied: www.daikinapplied.com/#sle.

3. Trane Inc: www.trane.com/#sle.

4. Substitutions: See Section 01 6000 - Product Requirements.

B. Coils: Copper tubes mechanically expanded into evenly spaced aluminum fins tested to operate at 150 psi (1034 kPa). Provide drain pan under cooling coil, easily removable for cleaning, with drain connection.

C. Cabinet: 0.0747 inch (1.9 mm) steel on solid base pan with exposed edges rounded. Provide removable front panels with quick-acting, key-operated cam locks. Provide removable die-cast or fabricated steel discharge grilles. For units having cooling coils, insulate internal parts and surfaces exposed to conditioned air stream with moisture resistant insulation.

D. Finish: Factory apply baked primer coat on visible surfaces of enclosure or cabinet.

E. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven, arranged to draw air through coil.

F. Wall Louvers: Anodized aluminum wall intake box and louvers removable from frame with 1/2 inch (13 mm) square mesh galvanized screen in back of louver.

G. Motor: ECM Motor.

H. Air Cooled Condensing Unit: Corrosion resistant cabinet, with hermetically sealed compressor with internal spring isolation, external isolation, permanent split capacitor motor and overload protection, copper tube aluminum fin condenser coil, direct drive propeller fan with permanently lubricated ball bearing single phase motor with internal overload protection.

I. Control: Multiple speed switch, factory wired, located in cabinet.

J. Filter: Easily removed 1 inch (25 mm) thick glass fiber throw-away type, located to filter air before coil.

K. Mixing Dampers: Multi-blade with compressible seal, capable of varying proportion of mixed air from 100 percent room air to 100 percent outside air.

L. Provide with manufacturer's adaptor back box for connection to new and/or existing louvers.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install equipment exposed to finished areas after walls and ceiling are finished and painted. Do not damage equipment or finishes.

C. Protection: Provide finished cabinet units with protective covers during balance of construction.

D. Finned Tube Radiation: Locate on outside walls and run cover wall-to-wall unless otherwise indicated. Center elements under windows. Where multiple windows occur over units, divide element into equal segments centered under each window. Align cabinet joints with window mullions. Install wall angles where units butt against walls.

E. Fan-Coil Units: Install as indicated. Coordinate to assure correct recess size for recessed units.

F. Unit Ventilators: Locate as indicated, level and shim units, and anchor to structure.

G. Hydronic Units: Provide with shut-off valve on supply and lockshield balancing valve on return piping. If not easily accessible, extend vent to exterior surface of cabinet for easy servicing. For cabinet unit heaters, fan coil units, and unit heaters, provide float operated automatic air vents with stop valve.

3.2 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

C. Install new filters.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air cooled condensing units.

B. Indoor air handling (fan and coil) units for ductless systems.

C. Controls.

1.2 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping: Includes indoor coil condensate drain, water supply for humidifier, and _____.

B. Section 23 0913 - Instrumentation and Control Devices for HVAC: Thermostats, humidistats, time clocks.

1.3 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2008.

B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; 2004.

C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2013.

D. ASHRAE Std 23.1 - Methods of Testing for Rating Positive Displacement Refrigerant Compressors and Condensing Units; 2010.

E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

F. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2015.

G. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

C. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.

D. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.6 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Daikin; _____: www.Daikin.com/#sle.

B. Trane Inc; _____: www.trane.com/#sle.

C. Substitutions: See Section 01 6000 - Product Requirements.

2.2 SYSTEM DESIGN

A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.

1. Heating: None.

2. Cooling: Outdoor electric condensing unit with evaporator coil in central ducted indoor unit.

3. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.

B. Performance Requirements: See Drawings for additional requirements.

2.3 INDOOR AIR HANDLING UNITS FOR DUCTLESS SYSTEMS

A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.

1. Location: Ceiling.

B. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.

1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.

2. Manufacturer: System manufacturer.

2.4 OUTDOOR UNITS

A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.

1. Refrigerant: R32.

2. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23.1and UL 207.

B. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.

1. Condenser Fans: Direct-drive propeller type.

2. Condenser Fan Motor: Enclosed, 1-phase type, permanently lubricated.

C. Coil: Air-cooled, aluminum fins bonded to copper tubes.

D. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gauge ports, thermometer well (in liquid line).

1. Provide thermostatic expansion valves.

2. Provide heat pump reversing valves.

E. Operating Controls:

1. Control by room thermostat to maintain room temperature setting.

2. Low Ambient Kit: Provide refrigerant pressure switch to cycle condenser fan on when condenser refrigerant pressure is above 285 psig (1965 kPa) and off when pressure drops below 140 psig (965 kPa) for operation to 0 degrees F (-18 degrees C).

2.5 ACCESSORY EQUIPMENT

A. Room Thermostat: Wall-mounted, electric solid state microcomputer based room thermostat with remote sensor to maintain temperature setting; low-voltage; with following features:

1. Automatic switching from heating to cooling.

2. Preferential rate control to minimize overshoot and deviation from setpoint.

3. Thermostat Display:

a. Actual room temperature.

b. System Mode Indication: Heating, Cooling, Fan Auto, Off, and On, Auto or On, Off.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.

B. Install in accordance with NFPA 90A and NFPA 90B.

C. Install refrigeration systems in accordance with ASHRAE Std 15.

D. Pipe drain from cooling coils to nearest floor drain and or janitors sink.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical demolition.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that abandoned wiring and equipment serve only abandoned facilities.

B. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. 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.

C. Existing Electrical Service: Maintain existing system in service. Disable system only to make switchovers and connections. Minimize outage duration.

1. Obtain permission from Owner at least 48 hours before partially or completely disabling system.

D. Existing Fire Alarm System: Maintain existing system in service. Disable system only to make switchovers and connections. Minimize outage duration.

1. Notify Owner before partially or completely disabling system.

2. Make notifications at least 24 hours in advance.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction.

B. Remove abandoned wiring to source of supply.

C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

E. Repair adjacent construction and finishes damaged during demolition and extension work.

F. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

3.4 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or that are to be reused.

B. Panelboards: For existing panelboards to be maintained and used for project, clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single conductor building wire.

B. Metal-clad cable.

C. Wiring connectors.

D. Electrical tape.

E. Cable ties.

1.2 RELATED REQUIREMENTS

A. Section 26 0505 - Selective Demolition for Electrical: Disconnection, removal, and/or extension of existing electrical conductors and cables.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011 (Reapproved 2017).

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).

E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2017.

F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2020.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

H. NECA 120 - Standard For Installing Armored Cable (Type AC) And Metal-Clad Cable (Type MC); 2018.

I. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.

J. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

M. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

N. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

O. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

P. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

Q. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

R. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

B. Field Quality Control Test Reports.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.5 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Service entrance cable is not permitted.

F. Armored cable is not permitted.

G. Metal-clad cable is permitted only as follows:

1. Where not otherwise restricted, may be used:

    a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.

        1 Maximum Length: 6 feet (1.8 m).

    b. Where concealed Selectively above accessible ceilings and in hollow wall partitions, where permission has been specifically given by the campus. for branch circuits up to 20 A.

        1 Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.

2. In addition to other applicable restrictions, may not be used:

    a. Unless approved by Owner.

    b. Where exposed to view.

    c. Where exposed to damage.

    d. For damp, wet, or corrosive locations, unless provided with a PVC jacket listed as suitable for those locations.

2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Provide new conductors and cables manufactured not more than one year prior to installation.

D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

E. Comply with NEMA WC 70.

F. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

G. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

H. Conductors for Grounding and Bonding: Also comply with Section 26 0526.

I. Conductor Material:

1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.

2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.

3. Tinned Copper Conductors: Comply with ASTM B33.

J. Minimum Conductor Size:

1. Branch Circuits: 12 AWG.

    a. Exceptions:

1 20 A, 120 V circuits longer than 75 feet (23 m): 10 AWG, for voltage drop.

2 20 A, 120 V circuits longer than 150 feet (46 m): 8 AWG, for voltage drop.

3 20 A, 277 V circuits longer than 150 feet (46 m): 10 AWG, for voltage drop.

2. Control Circuits: 14 AWG.

K. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

L. Conductor Color Coding:

1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.

2. Color Coding Method: Integrally colored insulation.

a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.

3. Color Code:

a. 208Y/120 V, 3 Phase, 4 Wire System:

1 Phase A: Black.

2 Phase B: Red.

3 Phase C: Blue.

4 Neutral/Grounded: White.

b. Equipment Ground, All Systems: Green.

c. Isolated Ground, All Systems: Green with yellow stripe.

d. Travelers for 3-Way and 4-Way Switching: Pink.

e. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.

f. For control circuits, comply with manufacturer's recommended color code.

2.3 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:

1. Copper Building Wire:

a. Cerro Wire LLC

b. Encore Wire Corporation

c. Southwire Company

B. Description: Single conductor insulated wire.

C. Conductor Stranding:

1. Feeders and Branch Circuits:

a. Size 10 AWG and Smaller: Stranded.

b. Size 8 AWG and Larger: Stranded.

2. Control Circuits: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:

1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2.

2.4 METAL-CLAD CABLE

A. Manufacturers:

1. AFC Cable Systems Inc

2. Encore Wire Corporation

3. Southwire Company

B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:

1. Size 10 AWG and Smaller: Stranded.

2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

F. Provide oversized neutral conductors where indicated or required.

G. Grounding: Full-size integral equipment grounding conductor.

H. Armor: Steel, interlocked tape.

I. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.

2.5 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 26 0526.

C. Wiring Connectors for Splices and Taps:

1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.

2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

D. Wiring Connectors for Terminations:

1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.

2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.

3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.

4. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.

5. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.

6. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F (105 degrees C) for standard applications and 302 degrees F (150 degrees C) for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

F. Push-in Wire Connectors: Rated 600 V, 221 degrees F (105 degrees C).

G. Mechanical Connectors: Provide bolted type or set-screw type.

H. Compression Connectors: Provide circumferential type or hex type crimp configuration.

I. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

2.6 ACCESSORIES

A. Electrical Tape:

1. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F (-18 degrees C) and suitable for continuous temperature environment up to 221 degrees F (105 degrees C).

a. Product: Scotch Super 33+.

b. Substitutions: See Section 01 6000 - Product Requirements.

2. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil (0.76 mm); suitable for continuous temperature environment up to 194 degrees F (90 degrees C) and short-term 266 degrees F (130 degrees C) overload service.

a. Product: Scotch 130C.

b. Substitutions: See Section 01 6000 - Product Requirements.

B. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

C. Cable Ties: Material and tensile strength rating suitable for application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.3 INSTALLATION

A. Circuiting Requirements:

1. Unless dimensioned, circuit routing indicated is diagrammatic.

2. When circuit destination is indicated without specific routing, determine exact routing required.

3. Arrange circuiting to minimize splices.

4. Include circuit lengths required to install connected devices within 10 ft (3.0 m) of location indicated.

5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.

6. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.

    a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.

    b. Increase size of conductors as required to account for ampacity derating.

    c. Size raceways, boxes, etc. to accommodate conductors.

7. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install metal-clad cable (Type MC) in accordance with NECA 120.

E. Installation in Raceway:

1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.

2. Pull all conductors and cables together into raceway at same time.

3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.

4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

H. Terminate cables using suitable fittings.

1. Metal-Clad Cable (Type MC):

a. Use listed fittings.

b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

I. Install conductors with a minimum of 12 inches (300 mm) of slack at each outlet.

J. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet (1.5 m) of slack.

K. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

L. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

M. Make wiring connections using specified wiring connectors.

1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.

2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.

3. Do not remove conductor strands to facilitate insertion into connector.

4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.

5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

N. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.

a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.

2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.

a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.

b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.

3. Wet Locations: Use heat shrink tubing.

O. Insulate ends of spare conductors using vinyl insulating electrical tape.

P. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

Q. Identify conductors and cables in accordance with Section 26 0553.

R. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods approved by UL.

S. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.4 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

C. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

1.2 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

B. Field quality control test reports.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E. Grounding System Resistance:

1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.

2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.

3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

F. Bonding and Equipment Grounding:

1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.

2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.

3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.

4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.

6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.

2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:

1. Provide products listed, classified, and labeled as suitable for the purpose intended.

2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:

1. Use insulated copper conductors unless otherwise indicated.

a. Exceptions:

1 Use bare copper conductors where installed underground in direct contact with earth.

2 Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:

1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.

2. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

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

B. Perform work in accordance with NECA 1 (general workmanship).

C. Make grounding and bonding connections using specified connectors.

1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.

2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.

3. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

4. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

D. Identify grounding and bonding system components in accordance with Section 26 0553.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.13.

C. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

D. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

E. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

1.2 RELATED REQUIREMENTS

A. Section 26 0533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

B. Section 26 0533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

C. Section 26 5100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

1.3 REFERENCE STANDARDS

A. MFMA-4 - Metal Framing Standards Publication; 2004.

1.4 ADMINISTRATIVE REQUIREMENTS

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.

2. Coordinate the work with other trades to provide additional framing and materials required for installation.

3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.

4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.

5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

6. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

a. Requirements of authorities having jurisdiction.

2. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.

3. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.

4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of _____. Include consideration for vibration, equipment operation, and shock loads where applicable.

5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.

6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.

    a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.

    b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated or specified on the Drawings. Supports shall match the materials of the equipment required to be supported.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

1. Minimum Size, Unless Otherwise Indicated or Required:

    a. Equipment Supports: 1/2 inch (13 mm) diameter.

    b. Busway Supports: 1/2 inch (13 mm) diameter.

    c. Single Conduit up to 1 inch (27 mm) trade size: 1/4 inch (6 mm) diameter.

    d. Single Conduit larger than 1 inch (27 mm) trade size: 3/8 inch (10 mm) diameter.

    e. Trapeze Support for Multiple Conduits: 3/8 inch (10 mm) diameter.

    f. Outlet Boxes: 1/4 inch (6 mm) diameter.

    g. Luminaires: 1/4 inch (6 mm) diameter.

F. Nonpenetrating Rooftop Supports for Low-Slope Roofs:

1. Manufacturers:

    a. Atkore International Inc; Unistrut

    b. Eaton Corporation

    c. Green Link, Inc

    d. PHP Systems/Design

2. Description: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring attachment to roof structure and not penetrating roofing assembly, with support fixtures as specified.

3. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.

4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.

5. Mounting Height: Provide minimum clearance of 6 inches (150 mm) under supported component to top of roofing.

6. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

PART 3 EXECUTION

3.1 EXAMINATION

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Equipment Support and Attachment:

1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.

2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.

3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.

4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

C. Conduit Support and Attachment: See Section 26 0533.13 for additional requirements.

D. Box Support and Attachment: See Section 26 0533.16 for additional requirements.

E. Interior Luminaire Support and Attachment: See Section 26 5100 for additional requirements.

F. Secure fasteners according to manufacturer's recommended torque settings.

3.3 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Flexible metal conduit (FMC).

C. Electrical metallic tubing (EMT).

D. Conduit fittings.

E. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Cable assemblies consisting of conductors protected by integral metal armor.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Section 26 0533.16 - Boxes for Electrical Systems.

E. Section 26 0533.23 - Surface Raceways for Electrical Systems.

F. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.

B. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

E. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.

2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.

3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.

4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.

5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Refer to the Raceway Schedule on the Electrical Drawings for permitted usage and restrictions.

C. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

D. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit or MC cable.

1. Maximum Length: 6 feet (1.8 m).

E. Connections to Vibrating Equipment:

1. Dry Locations: Use flexible metal conduit.

2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.

3. Maximum Length: 6 feet (1.8 m) unless otherwise indicated.

F. Fished in Existing Walls, Where Necessary: Use flexible metal conduit (FMC) or MC cable.

2.2 CONDUIT REQUIREMENTS

A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.

B. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Minimum Conduit Size, Unless Otherwise Indicated:

1. Branch Circuits: 3/4 inch (21 mm) trade size.

2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC OR GRS)

A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

B. Fittings:

1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

2. Material: Use steel or malleable iron.

a. Do not use die cast zinc fittings.

3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.4 FLEXIBLE METAL CONDUIT (FMC)

A. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

B. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

2. Material: Use steel or malleable iron.

a. Do not use die cast zinc fittings.

C. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

1. Material: Use steel or malleable iron.

a. Do not use die cast zinc fittings.

2.5 ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

2. Material: Use steel or malleable iron.

a. Do not use die cast zinc fittings.

3. Connectors and Couplings: Use set-screw type.

2.6 ACCESSORIES

A. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

B. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force (890 N).

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

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

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Conduit Routing:

1. Unless dimensioned, conduit routing indicated is diagrammatic.
2. When conduit destination is indicated without specific routing, determine exact routing required.
3. Conceal all conduits unless specifically indicated to be exposed.
4. Conduits in the following areas may be exposed, unless otherwise indicated:
    a. Electrical rooms.
    b. Mechanical equipment rooms.
    c. Within joists in areas with no ceiling.
5. Unless otherwise approved, do not route conduits exposed:
    a. Across floors.
    b. Across roofs.
    c. Across building exterior surfaces.
6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
7. Arrange conduit to maintain adequate headroom, clearances, and access.
8. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
9. Arrange conduit to provide no more than 150 feet (46 m) between pull points.

10. Route conduits above water and drain piping where possible.

11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.

12. Maintain minimum clearance of 6 inches (150 mm) between conduits and piping for other systems.

13. Maintain minimum clearance of 12 inches (300 mm) between conduits and hot surfaces. This includes, but is not limited to:

    a. Heaters.

    b. Hot water piping.

    c. Flues.

14. Group parallel conduits in the same area together on a common rack.

E. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.

2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.

4. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.

5. Use conduit clamp to support single conduit from beam clamp or threaded rod.

6. Use of wire for support of conduits is not permitted.

7. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with the most stringent requirements.

F. Connections and Terminations:

1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.

2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.

3. Use suitable adapters where required to transition from one type of conduit to another.

4. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.

5. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.

6. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

G. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.

2. Make penetrations perpendicular to surfaces unless otherwise indicated.

3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.

4. Conceal bends for conduit risers emerging above ground.

5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.

6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.

7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.

8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

H. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):

1. Include proposed conduit arrangement with submittals.

2. Maximum Conduit Size: 1 inch (27 mm) unless otherwise approved.

3. Secure conduits to prevent floating or movement during pouring of concrete.

I. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:

1. Where conduits cross structural joints intended for expansion, contraction, or deflection.

2. Where conduits are subject to earth movement by settlement or frost.

J. Conduit Sealing:

1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:

a. Where conduits enter building from outside.

b. Where service conduits enter building from underground distribution system.

c. Where conduits enter building from underground.

d. Where conduits may transport moisture to contact live parts.

2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:

a. Where conduits pass from outdoors into conditioned interior spaces.

b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

K. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches (300 mm) at each end.

L. Provide grounding and bonding in accordance with Section 26 0526.

M. Identify conduits in accordance with Section 26 0553.

3.3 FIELD QUALITY CONTROL

A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

B. Correct deficiencies and replace damaged or defective conduits.

3.4 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.5 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches (1,650 cu cm), including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches (1,650 cu cm).

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0533.13 - Conduit for Electrical Systems:

1. Conduit bodies and other fittings.

2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

D. Section 26 0533.23 - Surface Raceways for Electrical Systems:

E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 2726 - Wiring Devices:

1. Wall plates.

2. Floor box service fittings.

3. Access floor boxes.

4. Additional requirements for locating boxes for wiring devices.

G. Section 27 1000 - Structured Cabling: Additional requirements for communications systems outlet boxes.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

I. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

J. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.

4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.

5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.

6. Coordinate the work with other trades to preserve insulation integrity.

7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.

8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

C. Project Record Documents: Record actual locations for cabinets and enclosures, floor boxes, and underground boxes/enclosures.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 BOXES

A. General Requirements:

1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.

2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.

3. Provide products listed, classified, and labeled as suitable for the purpose intended.

4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches (1,650 cu cm), Including Those Used as Junction and Pull Boxes:

1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.

2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.

3. Use suitable concrete type boxes where flush-mounted in concrete.

4. Use suitable masonry type boxes where flush-mounted in masonry walls.

5. Use raised covers suitable for the type of wall construction and device configuration where required.

6. Use shallow boxes where required by the type of wall construction.

7. Do not use "through-wall" boxes designed for access from both sides of wall.

8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.

9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.

10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.

11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.

12. Minimum Box Size, Unless Otherwise Indicated:

    a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.

    b. Communications Systems Outlets: Comply with Section 27 1000.

13. Wall Plates: Comply with Section 26 2726.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):

1. Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E, or UL 508A.

2. NEMA EN 10250 Environment Type, Unless Otherwise Indicated:

    a. Indoor Clean, Dry Locations: Type 1, painted steel.

    b. Outdoor Locations: Type 3R, painted steel.

3. Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):

a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

4. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.

D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may be used.

E. Floor Boxes:

1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 2726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.

2. Manufacturer: Same as manufacturer of floor box service fittings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

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

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Box Locations:

1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 3100 as required where approved by the Architect.

2. Unless dimensioned, box locations indicated are approximate.

3. Locate boxes as required for devices installed under other sections or by others.

4. Locate boxes so that wall plates do not span different building finishes.

5. Locate boxes so that wall plates do not cross masonry joints.

6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.

7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches (150 mm) horizontal separation unless otherwise indicated.

8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) horizontal separation.

9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.

   a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.

10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0533.13.

I. Box Supports:

1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.

2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.

J. Install boxes plumb and level.

K. Flush-Mounted Boxes:

1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch (6 mm) or does not project beyond finished surface.

2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.

3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch (3 mm) at the edge of the box.

L. Install boxes as required to preserve insulation integrity.

M. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

N. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

O. Close unused box openings.

P. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

Q. Provide grounding and bonding in accordance with Section 26 0526.

R. Identify boxes in accordance with Section 26 0553.

3.3 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.4 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface raceway systems.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0533.13 - Conduit for Electrical Systems.

D. Section 26 0533.16 - Boxes for Electrical Systems.

E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 2726 - Wiring Devices: Receptacles.

G. Section 27 1000 - Structured Cabling: Voice and data jacks.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 5 - Surface Metal Raceways and Fittings; Current Edition, Including All Revisions.

D. UL 5A - Nonmetallic Surface Raceways and Fittings; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of raceways with millwork, furniture, equipment, etc. installed under other sections or by others.

2. Coordinate rough-in locations of outlet boxes provided under Section 26 0533.16 and conduit provided under Section 26 0533.13 as required for installation of raceways provided under this section.

3. Verify minimum sizes of raceways with the actual conductors and components to be installed.

4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install raceways until final surface finishes and painting are complete.

2. Do not begin installation of conductors and cables until installation of raceways is complete between outlet, junction and splicing points.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets including dimensions, knockout sizes and locations, materials, fabrication details, finishes, service condition requirements, and accessories.

1. Surface Raceway Systems: Include information on fill capacities for conductors and cables.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.1 RACEWAY REQUIREMENTS

A. Provide all components, fittings, supports, and accessories required for a complete raceway system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

2.2 SURFACE RACEWAY SYSTEMS

A. Manufacturers:

1. Hubbell Incorporated

2. MonoSystems, Inc

3. Wiremold, a brand of Legrand North America, Inc

B. Surface Metal Raceways: Listed and labeled as complying with UL 5.

C. Surface Nonmetallic Raceways: Listed and labeled as complying with UL 5A.

PART 3 EXECUTION

3.1 INSTALLATION

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

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install raceways plumb and level.

D. Secure and support raceways in accordance with Section 26 0529 at intervals complying with NFPA 70 and manufacturer's requirements.

E. Close unused raceway openings.

F. Provide grounding and bonding in accordance with Section 26 0526.

G. Identify raceways in accordance with Section 26 0553.

3.2 FIELD QUALITY CONTROL

A. Inspect raceways for damage and defects.

B. Surface Raceway Systems with Integrated Devices: Test each wiring device to verify operation and proper polarity.

C. Correct wiring deficiencies and replace damaged or defective raceways.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Warning signs and labels.

1.2 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

B. Section 27 1000 - Structured Cabling: Identification for communications cabling and devices.

1.3 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011 (Reaffirmed 2017).

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011 (Reaffirmed 2017).

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 70E - Standard for Electrical Safety in the Workplace; 2021.

E. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

PART 2 PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.

B. Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.

a. Panelboards:

1 Identify ampere rating.

2 Identify voltage and phase.

3 Identify power source and circuit number. Include location when not within sight of equipment.

4 Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.

5 For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

b. Enclosed switches, circuit breakers, and motor controllers:

1 Identify voltage and phase.

2 Identify power source and circuit number. Include location when not within sight of equipment.

3 Identify load(s) served. Include location when not within sight of equipment.

2. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.

a. Service equipment.

b. Industrial control panels.

c. Motor control centers.

d. Elevator control panels.

e. Industrial machinery.

3. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.

a. Minimum Size: 3.5 by 5 inches (89 mm by 127 mm).

b. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.

C. Identification for Conductors and Cables:

1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.

2. Identification for Communications Conductors and Cables: Comply with Section 27 1000.

3. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

4. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:

a. At each source and load connection.

D. Identification for Raceways:

1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet (6.1 m).

E. Identification for Boxes:

1. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.

F. Identification for Devices:

1. Identification for Communications Devices: Comply with Section 27 1000.

2. Wiring Device and Wallplate Finishes: Comply with Section 26 2726.

3. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.

a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.

2.2 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:

1. Materials:

a. Indoor Clean, Dry Locations: Use plastic nameplates.

b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.

2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch (1.6 mm); engraved text.

3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.

4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.

5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch (25 mm) high; Four, located at corners for larger sizes.

B. Identification Labels:

1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.

a. Use only for indoor locations.

2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:

1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).

2. Legend:

a. Equipment designation or other approved description.

3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height:

    a. Equipment Designation: 1/2 inch (13 mm).

    b. Exception: Provide minimum text height of 1 inch (25 mm) for equipment located more than 10 feet (3.0 m) above floor or working platform.

5. Color:

    a. Normal Power System: White text on black background.

D. Format for General Information and Operating Instructions:

1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).

2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.

3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height: 1/4 inch (6 mm).

5. Color: Black text on white background unless otherwise indicated.

E. Format for Caution and Warning Messages:

1. Minimum Size: 2 inches (51 mm) by 4 inches (100 mm).

2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.

3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height: 1/2 inch (13 mm).

5. Color: Black text on yellow background unless otherwise indicated.

F. Format for Receptacle Identification:

1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).

2. Legend: Power source and circuit number or other designation indicated.

3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height: 3/16 inch (5 mm).

5. Color: Black text on clear background.

G. Format for Fire Alarm Device Identification:

1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).

2. Legend: Designation indicated and device zone or address.

3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height: 3/16 inch (5 mm).

5. Color: Red text on white background.

2.3 WIRE AND CABLE MARKERS

A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

C. Legend: Power source and circuit number or other designation indicated.

D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

E. Minimum Text Height: 1/8 inch (3 mm).

F. Color: Black text on white background unless otherwise indicated.

2.4 VOLTAGE MARKERS

A. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

B. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

C. Minimum Size:

1. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.

D. Legend:

1. Markers for Voltage Identification: Highest voltage present.

2. Markers for System Identification:

E. Color: Black text on orange background unless otherwise indicated.

2.5 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:

1. Materials:

a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.

2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.

3. Minimum Size: 7 by 10 inches (178 by 254 mm) unless otherwise indicated.

C. Warning Labels:

1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.

2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.

3. Minimum Size: 2 by 4 inches (51 mm by 102 mm) unless otherwise indicated.

PART 3 EXECUTION

3.1 INSTALLATION

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

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:

1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: Inside of equipment door.
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Branch Devices: Adjacent to device.
5. Conduits: Legible from the floor.
6. Boxes: Outside face of cover.
7. Conductors and Cables: Legible from the point of access.
8. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Secure rigid signs using stainless steel screws.

G. Mark all handwritten text, where permitted, to be neat and legible.

H. Provide and affix a typewritten circuit directory card with a clear plastic cover to the inside of each panelboard door. Directory shall include the Panel ID, voltage rating, and current rating of the panel, as well as the circuit names (or spare circuit breakers or spare positions identified) fed by each circuit position on the panel.

3.2 FIELD QUALITY CONTROL

A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical connections to equipment.

1.2 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 26 0533.13 - Conduit for Electrical Systems.

C. Section 26 0533.16 - Boxes for Electrical Systems.

D. Section 26 2726 - Wiring Devices.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

2. Determine connection locations and requirements.

B. Sequencing:

1. Install rough-in of electrical connections before installation of equipment is required.

2. Make electrical connections before required start-up of equipment.

1.5 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.1 MATERIALS

A. Wiring Devices: As specified in Section 26 2726.

B. Flexible Conduit: As specified in Section 26 0533.13.

C. Wire and Cable: As specified in Section 26 0519.

D. Boxes: As specified in Section 26 0533.16.

E. Motor Rated Switches - Provide as scheduled, submit product data for Engineer Review.

2.2 EQUIPMENT CONNECTIONS

A. Refer to Mechancial Equipment Connection Schedule for Equipment List:

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

E. Install terminal block jumpers to complete equipment wiring requirements.

F. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. Extent of lighting control equipment Work is indicated by Drawings.

B. Types of lighting control equipment specified in this section include the following:

1. Analog Devices

a. Wall Mount Occupancy/Vacancy Sensors

b. Low Voltage Momentary Switches

c. Power Packs

2. Digital Devices

a. Digital Room Controllers

b. Digital Occupancy/Vacancy Sensors

c. Digital Switches/Dimmers

d. Digital Daylight Sensors

3. Emergency Bypass/Shunt Relays

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's data on control equipment and components.

B. Shop Drawings: Submit layout Drawings of control equipment and components.

C. Wiring Diagrams: Submit wiring and/or schematic diagrams for control equipment and components showing control and interconnection wiring, including connections to equipment components and electrical power feeders. Differentiate between portions of wiring that are manufacturer-installed and portions that are field-installed.

D. Maintenance Manuals: Furnish maintenance manuals that contain equipment cuts, operating instructions, troubleshooting procedures, and spare parts list for equipment. Ensure manual includes operating instructions in addition to instructions for maintenance of the system.

E. Factory Commissioning & Startup

1. Provide commissioning personnel resume's and experience for approval. Personnel shall have fully commissioned at least 5 systems in the past 24 months.

2. Submit final commissioning report.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of control equipment and ancillary equipment, of types, ratings and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firm with at least five successfully completed projects of similar scope.

C. Codes and Standards:

1. Electrical Code Compliance: Comply with applicable local electrical code requirements of the Authority Having Jurisdiction and NEC as applicable to construction, installation of lighting control and communications equipment.

2. UL Compliance: Provide lighting control equipment and components that are UL-listed and labeled.

3. NEMA Compliance: Comply with applicable requirements of NEMA's Stds Pub No. 250, "Enclosures for Electrical Equipment (1000-Volts Maximum)."

4. International Energy Conservation Code.

5. ANSI/ASHRAE/IESNA 90.1 requirements.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver control equipment and components in factory-fabricated type containers or wrappings, which properly protect equipment from damage.

B. Store control equipment in original packaging and protect from weather and construction traffic.

C. Handle control equipment carefully to prevent physical damage to equipment and components. Do not install damaged equipment; remove from site and replace damaged equipment with new.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide indoor lighting control equipment that meets or exceeds the requirements outlined in this specification.

1. Basis of Design - Legrand Wattstopper, Inc.

2. Subject to compliance with requirements, or equal products are permitted. Products must meet or exceed the requirements of this specification.

2.2 INTERIOR LIGHTING CONTROL DEVICES - ANALOG

A. General: Provide factory fabricated occupancy/vacancy sensor controls consisting of passive infrared and/or ultrasonic motion which scans an area in search of changes in temperature and/or motion caused by the presence, or absence, of people within the desired viewing area. When no presence is detected for a period of up to 20 minutes, the lights are switched off.

B. Dual Technology Wall Mounted Sensors

1. Unit shall have minimum 180 degree viewing angle, 35' x 30’ major motion and 20’ x 20’ minor motion range (PIR), 20' x 20’ major motion and 15’ x 15’ minor motion range (Ultrasonic); and positive detector indication.

2. Capable of switching all types of fluorescent ballasts, both solid-state electronic and magnetic ballasts, and incandescent lighting loads.

3. Dual element detection with time-out delay adjustable from 5 seconds to 20 minutes.

4. Shall be provided with neutral terminal as required by NEC.

5. Shall be rated for minimum 800 Watts at 120 VAC or 1200 Watts at 277 VAC.

6. Shall factory default to manual on operation and be equipped with manual off override, UL listed.

7. Ivory color protruding less than 1" from wall plate, mounts in single gang outlet box and utilizes decorator style rectangular opening wall plate, stainless steel, satin finish.

8. Basis of Design Manufacturer:

    a. Legrand Wattstopper DW-100 series

C. Dual Technology Wall Mounted Dimmable Sensors

1. Similar to above paragraph (B), except capable of dimming (0-10V) lighting loads.

2. Basis of Design Manufacturer:

    a. Legrand Wattstopper DW-311

D. Low Voltage Momentary Switch

1. Single button, wall switch with momentary contact intended for use with compatible low voltage relay panels or power packs

2. LED indicator light

3. 24VDC, 50mA

4. Basis of Design Manufacturer:

    a. Legrand Wattstopper LVSW-100 series (1 button 101, 2 button 102..)

E. Power Packs for Low Voltage Occupancy Sensors:

1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.

2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on the drawings. (note - power packs not shown on plan)

3. Input Supply Voltage: Dual rated for 120/277 V ac.

4. Load Rating: As required to control the load indicated on the drawings.

2.3 INTERIOR LIGHTING CONTROL DEVICES - DIGITAL

A. DLM Local Network (Room Network)

1. The DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.

2. Features of the DLM local network include:

    a. Plug n' G automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.

b. Simple replacement of any device in the local DLM network with a standard off the shelf unit without requiring significant commissioning, configuration or setup.

c. Push n' Learn™ configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.

d. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.

3. Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.

4. If manufacturer's pre-terminated Cat5e cables are not used for the installation, the contractor is responsible for testing each cable following installation and supplying manufacturer with test results.

5. Basis of Design Manufacturer

a. WattStopper Product Number: LMRJ-Series

B. Digital Load Controllers (Lighting Load & Plug Load)

1. Digital controllers for lighting and plug loads automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room and plug load controllers shall be provided to match the room lighting and plug load control requirements. The controllers will be simple to install, and will not have dip switches or potentiometers, or require special configuration for standard Plug n' Go applications. The control units will include the following features:

a. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.

b. Simple replacement - Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf.

c. Multiple room controllers connected together in a local network must automatically arbitrate with each other, without requiring any configuration or setup, so that individual load numbers are sequentially assigned using each controller's device ID's from highest to lowest.

d. Device Status LEDs to indicate:

1 Data transmission

2 Device has power

3 Status for each load

4 Configuration status

e. Quick installation features including:

1 Standard junction box mounting

2 Quick low voltage connections using standard RJ-45 patch cable

f. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:

1 Turn on to 100%

2 Turn off

3 Turn on to last level

g. Each load shall at a minimum be configurable to operate in the following sequences based on occupancy:

1 Auto-on/Auto-off (Follow on and off)

2 Manual-on/Auto-off (Follow off only)

h. The polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.

i. BACnet object information shall be available for the following objects:

1 Load status

2 Electrical current (when available)

3 Total watts per controller

4 Schedule state - normal or after-hours

5 Demand response enable and disable

6 Room occupancy status

7 Total room lighting and plug loads watts

8 Total room watts/sq ft

9 Force on/off all loads

j. UL 2043 plenum rated

k. Manual override and LED indication for each load

l. Dual voltage (120/277 VAC, 60 Hz), or 347 VAC, 60 Hz (selected models only). 120/277 volt models rated for 20A total load, derating to 16A required for some dimmed loads (forward phase dimming); 347 volt models rated for 15A total load; plug load controllers carry application-specific UL 20 rating for receptacle control.

m. Zero cross circuitry for each load

n. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.

2. On/Off/Dimming enhanced Room Controllers shall include:

a. Real time current monitoring

b. Multiple relay configurations

1 One, two or three relays (LMRC-21x series)

c. Efficient 250 mA switching power supply

d. Four RJ-45 DLM local network ports with integral strain relief and dust cover

e. One dimming output per relay

1 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting. (LMRC-21x series)

2 Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver.

3 The LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.

4 Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100% dimming range defined by the minimum and maximum calibration trim.

5 Calibration and trim levels must be set per output channel.

6 Devices that set calibration or trim levels per controller are not acceptable.

7 All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.

f. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.

g. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.

h. The following dimming attributes may be changed or selected using a wireless configuration tool:

1 Establish preset level for each load from 0-100%

2 Set high and low trim for each load

3 Set lamp burn in time for each load up to 100 hours

i. Override button for each load provides the following functions:

1 Press and release for on/off control

2 Press and hold for dimming control

j. Acceptable Manufacturer's

1 WattStopper product numbers: LMRC-211, LRMC-212, LRMC-213

C. Digital Wall or Ceiling Mounted Occupancy/Vacancy Sensors

1. Wall or ceiling mounted (to suit installation) passive infrared (PIR), ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor.

2. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:

a. Digital calibration and pushbutton configuration for the following variables:

1 Sensitivity - 0-100% in 10% increments

2 Time delay - 1-30 minutes in 1 minute increments

3 Test mode - Five second time delay

4 Detection technology - PIR, Ultrasonic or Dual Technology activation and/or re-activation.

5 Walk-through mode

b. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.

c. Programmable control functionality including:

1 Each sensor may be programmed to control specific loads within a local network.

2 Sensor shall be capable of activating one of 16 user-definable lighting scenes.

3 Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.

4 On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:

5 Ultrasonic and Passive Infrared

6 Ultrasonic or Passive Infrared

7 Ultrasonic only

8 Passive Infrared only

9 Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.

d. One or two RJ-45 port(s) for connection to DLM local network.

e. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.

f. Device Status LEDs, which may be disabled for selected applications, including:

1 PIR detection

2 Ultrasonic detection

3 Configuration mode

4 Load binding

g. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.

h. Manual override of controlled loads.

i. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.

D. Digital Wall Switches

1. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features:

    a. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.

    b. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.

    c. Configuration LED on each switch that blinks to indicate data transmission.

    d. Load/Scene Status LED on each switch button with the following characteristics:

        1 Bi-level LED

        2 Dim locator level indicates power to switch

        3 Bright status level indicates that load or scene is active

        4 Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.

    e. Programmable control functionality including:

        1 Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority

        2 Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.

    f. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.

2. BACnet object information shall be available for the following objects:

    a. Button state

    b. Switch lock control

    c. Switch lock status

3. Two RJ-45 ports for connection to DLM local network.

4. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.

5. The following switch attributes may be changed or selected using a wireless configuration tool:

6. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).

    a. Individual button function may be configured to Toggle, On only or Off only.

    b. Individual scenes may be locked to prevent unauthorized change.

    c. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.

    d. Ramp rate may be adjusted for each dimmer switch.

e. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependant; each button may be bound to multiple loads.

7. Basis of Design Manufacturer

a. WattStopper product numbers: LMSW-102, LMDM-10 compatible with wall plates with decorator opening.

E. Digital Daylighting Sensors

1. Digital daylighting sensors shall work with load controllers and relay panels to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to the controller or panel. Daylighting sensors shall be interchangeable without the need for rewiring.

a. Open loop sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones.

2. Digital daylighting sensors shall include the following features:

a. The sensor's internal photodiode shall only measure lightwaves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. The photodiode shall not measure energy in either the ultraviolet or infrared spectrum's. The photocell shall have a sensitivity of less than 5% for any wavelengths less than 400 nanometers or greater than 700 nanometers.

b. Sensor light level range shall be from 1-6,553 footcandles (fc).

c. The capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of load controller(s) and load binding to controller(s).

d. For switching daylight harvesting, the photosensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.

e. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.

f. Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.

g. Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.

h. Optional wall switch override shall allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise lighting levels for a selectable period of time or cycle of occupancy.

i. Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.

j. Configuration LED status light on device that blinks to indicate data transmission.

k. Status LED indicates test mode, override mode and load binding.

l. Recessed switch on device to turn controlled load(s) ON and OFF.

m. BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell's settings:

1 Light level

2 Day and night setpoints

3 Off time delay

4 On and off setpoints

5 Up to three zone setpoints

6 Operating mode - on/off, bi-level, tri-level or dimming

n. One RJ-45 port for connection to DLM local network.

o. A choice of accessories to accommodate multiple mounting methods and building materials. The photosensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate mounting materials from 0-0.62" thickness (LMLS-400, LMLS-500). Extended tube photosensors accommodate mounting materials from 0.62"-1.25" thickness (LMLS-400-L, LMLS-500-L). Mounting brackets are compatible with J boxes (LMLS-MB1) and wall mounting (LMLS-MB2). LMLS-600 photosensor to be mounted on included bracket below skylight well.

p. Any load or group of loads in the room can be assigned to a daylighting zone

q. Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).

r. All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.

3. Open loop digital photosensors shall include the following additional features:

a. An internal photodiode that measures light in a 60-degree angle (cutting off the unwanted light from the interior of the room).

b. Automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling; for dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone.

c. Each of the three discrete daylight zones can include any non overlapping group of loads in the room.

d. Basis of Design WattStopper Product Number: LMLS-500, LMLS-500-L.

F. Handheld and Computer Configuration Tools

1. A wireless configuration tool facilitates optional customization of DLM local networks using two-way infrared communications, while PC software connects to each local network via a USB interface.

2. Features and functionality of the wireless configuration tool shall include but not be limited to:

a. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.

b. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.

c. Must be able to read and modify parameters for load controllers and relay panels, occupancy sensors, wall switches, daylighting sensors, network bridges, and identify DLM devices by type and serial number.

d. Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors.

e. Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.

f. Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.

g. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.

h. Verify status of building level network devices.

3. Provide 1 unit, turn over to owner during commissioning, for use with this project.

4. Basis of Design Manufacturer: WattStopper Product Numbers: LMCT-100, LMCI-100/LMCS-100

2.4 EMERGENCY BYPASS/SHUNT RELAY

A. A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:

1. 120/277 volts, 50/60 Hz, 20 amp ballast rating

2. Push to test button

3. Auxiliary contact for remote test or fire alarm system interface

a. Acceptable Manufacturer's

b. WattStopper Product Numbers: ELCU-100, ELCU-200

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which control equipment is to be installed and notify Architect in writing of conditions detrimental to proper completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF CONTROL EQUIPMENT

A. Install control system components and ancillary equipment as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that lighting control equipment complies with requirements. Comply with requirements of NEC, and applicable portions of NECA's "Standard of Installation" pertaining to general electrical installation practices.

B. Coordinate with other electrical Work, including raceways, and electrical boxes and fittings, as necessary to interface installation of lighting control equipment Work.

3.3 INSTALLATION OF OCCUPANCY/VACANY SENSORS

A. All units shall be secured to an outlet box and per manufacturer's written installation instructions; Drawings are for informational purposes only. Manufacturer shall have field-trained rep available to assist Contractor during installation.

B. All necessary wiring diagrams shall be furnished to Contractor by manufacturer for installation.

C. All sensors shall be adjusted in field to pick up door swing within range of viewer; Contractor shall adjust or move device as required.

D. Provide all necessary control units, relays, wallplates, mounting brackets, filters, sensor covers, backboxes and other equipment necessary to make completely operational system. All equipment but sensor shall be recess mounted, concealed.

E. All control units shall be wired such that wall switches (if present) can switch room lamps off. Program occupancy sensor control so that the occupant is required to manually turn ON the lights when re-entering the room, in compliance with the Energy Conservation Construction Code.

F. Provide all required additional sensors for complete room coverage as required by system.

G. Wall sensors shall be mounted at same height as switches.

H. Provide complete written checkout signed by manufacturer's representative, Contractor and Owner's Site Representative after complete installation of system.

1. All occupancy sensor wiring, including both power and control wiring, shall be installed in raceway systems as specified.

2. Wire vacancy sensors so that lighting shuts off at or less than 15 minutes after the occupant leaves the room. It will be necessary for the occupant to manually turn the lights back on.

3. Wire the occupancy sensors that control the split-wire controlled receptacles so that the top portion of each controlled duplex receptacle shuts off less than 20 minutes after the occupant leaves the room. It is not necessary for the occupant to manually turn the receptacles back on; they shall automatically energize upon returning to the room.

3.4 INSTALLATION OF EMERGENCY BYPASS/SHUNT RELAY

A. Install in accordance with manufacturer’s printed instructions as a shunt or bypass device, unless otherwise noted.

B. Install relay device concealed above accessible ceiling, mounted to outlet box. Install test switch on wall 12” below ceiling, flush mounted.

C. Test each unit to ensure proper operation.

3.5 PERSONNEL TRAINING

A. Building Operating Personnel Training: Train Owner's building personnel in procedures for starting-up, testing and operating lighting control system equipment.

B. Provide two 1 hour sessions to train facility personnel on the use, operation and maintenance of the system.

3.6 FACTORY COMMISSIONING & STARTUP

A. Upon completion of the installation, the system shall be fully commissioned by the manufacturer's factory authorized representative who will verify, program/set and witness test the fully functional system

1. Confirm occupancy sensors acceptable performance of placement, sensitivity and settings.

2. Confirm time switches and schedule controls are correctly programmed, functioning and documented.

3. Confirm daylighting responsive controls are properly located, calibrated, accessible and function to adjust lighting in response to available daylight.

4. Submit documentation certifying performance.

END OF SECTION 26 09 23

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e (Amended 2017).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.

D. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

E. NEMA PB 1 - Panelboards; 2011.

F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.

G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

K. UL 67 - Panelboards; Current Edition, Including All Revisions.

L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

M. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.

4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.

2. Include wiring diagrams showing all factory and field connections.

C. Field Quality Control Test Reports.

D. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:

1. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB/GE

B. Eaton Corporation

C. General Electric Company

D. Schneider Electric; Square D Products

E. Siemens Industry, Inc

F. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet (2,000 m).

2. Ambient Temperature:

a. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).

C. Short Circuit Current Rating:

1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

F. Bussing: Sized in accordance with UL 67 temperature rise requirements.

1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.

2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:

a. Indoor Clean, Dry Locations: Type 1.

2. Boxes: Galvanized steel unless otherwise indicated.

a. Provide wiring gutters sized to accommodate the conductors to be installed.

b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.

c. Provide painted steel boxes for surface-mounted panelboards where indicated, finish to match fronts.

3. Fronts:

a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.

b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.

c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.

4. Lockable Doors: All locks keyed alike unless otherwise indicated.

I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

J. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.

K. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.

L. Load centers are not acceptable.

M. Provide the following features and accessories where indicated or where required to complete installation:

1. Feed-through lugs.

2. Sub-feed lugs.

2.3 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:

1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.

2. Main and Neutral Lug Type: Mechanical.

C. Bussing:

1. Phase and Neutral Bus Material: Copper.

2. Ground Bus Material: Copper.

D. Circuit Breakers:

1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.

E. Enclosures:

1. Provide surface-mounted enclosures unless otherwise indicated.

2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.

3. Provide clear plastic circuit directory holder mounted on inside of door.

2.4 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:

1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.

2. Main and Neutral Lug Type: Mechanical.

C. Bussing:

1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.

2. Phase and Neutral Bus Material: Copper.

3. Ground Bus Material: Copper.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:

1. Provide surface-mounted or flush-mounted enclosures as indicated.

2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.

3. Provide clear plastic circuit directory holder mounted on inside of door.

F. Provide column-width panelboards where regular width panelboards will not fit in the field.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:

1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.

2. Interrupting Capacity:

a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:

b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

3. Conductor Terminations:

a. Lug Material: Copper, suitable for terminating copper conductors only.

4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.

    a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.

5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

6. Provide the following circuit breaker types where indicated:

    a. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.

7. Do not use tandem circuit breakers.

8. Do not use handle ties in lieu of multi-pole circuit breakers.

9. Provide the following features and accessories where indicated or where required to complete installation:

    a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 26 0529.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches (2000 mm) above the floor or working platform.

I. Provide minimum of six spare 1 inch (27 mm) trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

J. Provide grounding and bonding in accordance with Section 26 0526.

1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.

K. Install all field-installed branch devices, components, and accessories.

L. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

M. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

N. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

O. Provide filler plates to cover unused spaces in panelboards.

P. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:

1. Emergency and night lighting circuits.

2. Fire detection and alarm circuits.

3. Communications equipment circuits.

Q. Identify panelboards in accordance with Section 26 0553.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 100 amperes. Tests listed as optional are not required.

C. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

D. Test GFCI circuit breakers to verify proper operation.

E. Test shunt trips to verify proper operation.

F. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.5 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Wall plates.

D. Floor box service fittings.

E. Poke-through assemblies.

1.2 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0533.16 - Boxes for Electrical Systems.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 0583 - Wiring Connections: Cords and plugs for equipment.

F. Section 26 0923 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors.

G. Section 26 2913 - Enclosed Controllers: Manual motor starters and horsepower rated motor-starting switches without overload protection.

H. Section 27 1000 - Structured Cabling: Voice and data jacks.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

E. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.5 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 PRODUCTS

2.1 WIRING DEVICES - GENERAL REQUIREMENTS

A. Provide wiring devices suitable for intended use with ratings adequate for load served.

B. Wiring Device Applications:

1. Receptacles Installed Outdoors or in Damp or Wet Locations: Use weather-resistant GFCI receptacles with weatherproof covers.

2. Provide GFCI protection for:

a. Receptacles installed within 6 feet (1.8 m) of sinks.

b. Receptacles installed in kitchens.

c. Receptacles serving electric drinking fountains.

3. Single Receptacles Installed on Individual Branch Circuits: Provide receptacle ampere rating equal to branch circuit rating.

C. Wiring Device Finishes:

1. Provide wiring device finishes as described below, unless otherwise indicated.

2. Wiring Devices, Unless Otherwise Indicated: White with white nylon wall plate.

3. Wiring Devices Installed in Finished Spaces: White with white nylon wall plate.

4. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.

5. Wiring Devices Installed in Wet or Damp Locations: White with weatherproof cover.

2.2 MANUFACTURERS

A. Hubbell Incorporated

B. Leviton Manufacturing Company, Inc

C. Lutron Electronics Company, Inc

D. Pass & Seymour, a brand of Legrand North America, Inc

2.3 WALL SWITCHES

A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.

B. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.4 RECEPTACLES

A. Manufacturers:

1. Hubbell Incorporated
2. Leviton Manufacturing Company, Inc
3. Lutron Electronics Company, Inc; Designer Style
4. Pass & Seymour, a brand of Legrand North America, Inc
5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.

1. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:

1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
2. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.

D. GFCI Receptacles:

1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.
4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.

2.5 WALL PLATES

A. Wall Plates: Comply with UL 514D.

1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Size: Standard.
3. Screws: Metal with slotted heads finished to match wall plate finish.

B. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.

C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

D. Weatherproof Receptacle Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

2.6 FLOOR BOX SERVICE FITTINGS

A. Description: Service fittings compatible with floor boxes provided under Section 26 0533.16 with components, adapters, and trims required for complete installation.

2.7 POKE-THROUGH ASSEMBLIES

A. Description: Assembly comprising floor service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination; fire rating listed to match fire rating of floor and suitable for floor thickness where installed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section.

1. Mounting Heights: Unless otherwise indicated, as follows:

   a. Wall Switches: 48 inches (1200 mm) above finished floor.

   b. Receptacles: 18 inches (450 mm) above finished floor or 6 inches (150 mm) above counter.

2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.

3. Where multiple wall switches are installed at the same location and at the same mounting height, gang devices together under a common wall plate.

4. Locate wall switches on strike side of door with edge of wall plate 3 inches (80 mm) from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches (150 mm) long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Install wiring devices plumb and level with mounting yoke held rigidly in place.

J. Install wall switches with OFF position down.

K. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

L. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

M. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

N. Identify wiring devices in accordance with Section 26 0553.

O. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.

3.3 FIELD QUALITY CONTROL

A. Inspect each wiring device for damage and defects.

B. Operate each wall switch with circuit energized to verify proper operation.

C. Test each receptacle to verify operation and proper polarity.

D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.4 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

END OF SECTION

CIRCUIT BREAKERS FOR EXISTING PANELBOARDS 26 2815

PART 1 GENERAL

1.1 SUBMITTALS

A. Not required.

PART 2 PRODUCTS

2.1 CIRCUIT BREAKERS

A. Similar to existing circuit breakers.

B. Compatible with existing panelboard/switchboard.

C. Number of poles and ampere trip rating as indicated on drawings.

D. Complete with accessories required for installation.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install new circuit breakers in existing panelboards where indicated.

B. Add new circuits equally across phases to prevent overloading any phase in the panelboard. After new and existing circuits are energized, take current reading on panelboard feeder during a heavy usage time period. If phases are substantially unbalanced, rearrange both new and existing circuits in panelboard to equally distribute load between all phases, and provide new typewritten directory indicating equipment controlled by each circuit breaker.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Enclosed circuit breakers.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e (Amended 2017).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for circuit breakers, enclosures, and other installed components and accessories.

B. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of enclosed circuit breakers and adjacent equipment with all required clearances indicated.

C. Project Record Documents: Record actual installed locations of enclosed circuit breakers.

1.5 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB

B. Eaton Corporation

C. Schneider Electric

D. Siemens Industry, Inc

2.2 ENCLOSED CIRCUIT BREAKERS

A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet (2,000 m).

2. Ambient Temperature: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).

D. Short Circuit Current Rating:

1. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location indicated on the drawings.

E. Conductor Terminations: Suitable for use with the conductors to be installed.

F. Provide thermal magnetic circuit breakers unless otherwise indicated.

G. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.

H. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:

a. Indoor Clean, Dry Locations: Type 1.

2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

3. Provide surface-mounted enclosures unless otherwise indicated.

I. Provide externally operable handle with means for locking in the OFF position.

2.3 MOLDED CASE CIRCUIT BREAKERS

A. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.

B. Interrupting Capacity:

1. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:

2. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

C. Conductor Terminations:

1. Lug Material: Copper, suitable for terminating copper conductors only.

D. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.

1. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.

2. Provide interchangeable trip units for circuit breaker frame sizes 250 amperes and larger.

E. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

PART 3 EXECUTION

3.1 INSTALLATION

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

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install enclosed circuit breakers plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 0526.

H. Set field-adjustable circuit breaker tripping function settings as directed.

I. Identify enclosed circuit breakers in accordance with Section 26 0553.

3.2 FIELD QUALITY CONTROL

A. Inspect and test in accordance with manufacturer's instructions and NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.6.1.1. Tests listed as optional are not required.

C. Correct deficiencies and replace damaged or defective enclosed circuit breakers.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Enclosed safety switches.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 2913 - Enclosed Controllers: Manual motor controllers.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

C. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C) during and after installation of enclosed switches.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Eaton Corporation

B. General Electric Company

C. Schneider Electric; Square D Products

D. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet (2,000 m).

2. Ambient Temperature: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:

1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

2. Minimum Ratings:

a. Switches Protected by Class H Fuses: 10,000 rms symmetrical amperes.

b. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.

c. Double Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.

G. Provide with switch blade contact position that is visible when the cover is open.

H. Fuse Clips for Fusible Switches: As required to accept fuses indicated.

1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

I. Conductor Terminations: Suitable for use with the conductors to be installed.

J. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

K. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

L. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:

a. Indoor Clean, Dry Locations: Type 1.

b. Outdoor Locations: Type 3R.

2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

M. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

N. Heavy Duty Switches:

1. Comply with NEMA BS 31047.

2. Conductor Terminations:

a. Lug Material: Copper, suitable for terminating copper conductors only.

3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

O. Provide the following features and accessories where indicated or where required to complete installation:

1. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

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

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 0526.

H. Provide fuses complying with Section 26 2813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

I. Identify enclosed switches in accordance with Section 26 0553.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

C. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Enclosed NEMA controllers for low-voltage (600 V and less) applications:

1. Motor-starting switches without overload protection.

B. Overcurrent protective devices for motor controllers, including overload relays.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

E. NEMA IA 10030 - Industrial Control and Systems: Enclosures; 2024.

F. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules; Current Edition, Including All Revisions.

I. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.

B. Shop Drawings: Indicate dimensions, voltage, controller sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1.5 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB

B. Eaton Corporation

C. Rockwell Automation, Inc

D. Schneider Electric

E. Siemens Industry, Inc

2.2 ENCLOSED CONTROLLERS

A. Provide enclosed controller assemblies consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Description: Enclosed controllers complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; ratings, configurations and features as indicated on the drawings.

D. Service Conditions:

1. Provide controllers and associated components suitable for operation under the following service conditions without derating:

a. Altitude:

1 Class 1 Km Equipment (devices utilizing power semiconductors, e.g. variable frequency controllers): Less than 3,300 feet (1,000 m).

2 Class 2 Km Equipment (electromagnetic and manual devices): Less than 6,600 feet (2,000 m).

b. Ambient Temperature: Between 32 degrees F (0 degrees C) and 104 degrees F (40 degrees C).

2. Provide controllers and associated components suitable for operation at indicated ratings under the service conditions at the installed location.

E. Short Circuit Current Rating:

1. Provide controllers with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

F. Conductor Terminations: Suitable for use with the conductors to be installed.

G. Enclosures:

1. Comply with NEMA IA 10030.

2. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:

a. Indoor Clean, Dry Locations: Type 1 or Type 12.

b. Outdoor Locations: Type 3R or Type 4.

3. Finish: Manufacturer's standard unless otherwise indicated.

H. Instrument Transformers:

1. Comply with IEEE C57.13.

2. Select suitable ratio, burden, and accuracy as required for connected devices.

3. Current Transformers: Connect secondaries to shorting terminal blocks.

4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

I. Motor-Starting Switches: Horsepower-rated switches without overload protection; toggle operator.

2.3 OVERCURRENT PROTECTIVE DEVICES

A. Overload Relays:

1. Provide overload relays and, where applicable, associated current elements/heaters, selected according to actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.

2. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.

3. Trip-free operation.

4. Visible trip indication.

5. Resettable.

a. Employ manual reset unless otherwise indicated.

b. Do not employ automatic reset with two-wire control.

PART 3 EXECUTION

3.1 INSTALLATION

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

B. Install controllers in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install enclosed controllers plumb and level.

F. Provide grounding and bonding in accordance with Section 26 0526.

G. Install all field-installed devices, components, and accessories.

H. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

I. Set field-adjustable controllers and associated components according to installed motor requirements, in accordance with manufacturer's recommendations and NFPA 70.

J. Identify enclosed controllers in accordance with Section 26 0553.

3.2 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Motor Starters: Perform inspections and tests listed in NETA ATS, Section 7.16.1.1. Tests listed as optional are not required.

C. Correct deficiencies and replace damaged or defective enclosed controllers or associated components.

3.3 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of controllers to Owner, and correct deficiencies or make adjustments as directed.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

1.2 RELATED REQUIREMENTS

A. Section 26 0529 - Hangers and Supports for Electrical Systems.

B. Section 26 0533.16 - Boxes for Electrical Systems.

C. Section 26 0923 - Lighting Control Devices.

1.3 REFERENCE STANDARDS

A. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2019.

B. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; Illuminating Engineering Society; 2008.

C. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; 2019.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

E. NECA/IESNA 500 - Standard for Installing Indoor Lighting Systems; 2006.

F. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

G. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

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

J. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

K. UL 1598 - Luminaires; Current Edition, Including All Revisions.

L. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.

2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.

3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.

4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

A. Shop Drawings:

1. Provide photometric calculations where luminaires are proposed for substitution upon request.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:

a. Include estimated useful life, calculated based on IES LM-80 test data.

b. Include IES LM-79 test report upon request.

C. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. Provide 3-year manufacturer warranty for LED luminaires, including drivers.

PART 2 PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.2 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Recessed Luminaires:

1. Ceiling Compatibility: Comply with NEMA LE 4.

H. LED Luminaires:

1. Components: UL 8750 recognized or listed as applicable.

2. Tested in accordance with IES LM-79 and IES LM-80.

3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

I. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.3 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:

1. Sealed maintenance-free nickel cadmium unless otherwise indicated.

2. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

2.4 EXIT SIGNS

A. Description: Exit signs and similar signs for special purpose applications such as area of refuge/rescue assistance.

B. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.

1. Number of Faces: Single- or double-face as indicated or as required for installed location.

2. Directional Arrows: As indicated or as required for installed location.

C. Powered Exit Signs: Internally illuminated with LEDs unless otherwise indicated.

1. Self-Powered Exit Signs:

a. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

b. Battery: Sealed, maintenance-free, nickel cadmium unless otherwise indicated.

c. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

d. Provide low-voltage disconnect to prevent battery damage from deep discharge.

2.5 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

E. Provide required support and attachment in accordance with Section 26 0529.

F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

G. Suspended Ceiling Mounted Luminaires:

1. Do not use ceiling tiles to bear weight of luminaires.

2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.

3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.

4. Secure pendant-mounted luminaires to building structure.

5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.

6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gauge, connected from opposing corners of each recessed luminaire to building structure.

7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

H. Recessed Luminaires:

1. Install trims tight to mounting surface with no visible light leakage.

2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.

I. Suspended Luminaires:

1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.

2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.

3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet (1.2 m) between supports.

J. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

K. Install accessories furnished with each luminaire.

L. Bond products and metal accessories to branch circuit equipment grounding conductor.

M. Emergency Lighting Units:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

N. Exit Signs:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

3.4 FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

C. Test self-powered exit signs and emergency lighting units to verify proper operation upon loss of normal power supply.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.5 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.6 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

3.7 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Communications system design requirements.

B. Communications pathways.

C. Copper cable and terminations.

D. Communications equipment room fittings.

E. Communications outlets.

F. Communications grounding and bonding.

G. Communications identification.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0533.16 - Boxes for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products.

D. Section 26 2726 - Wiring Devices.

1.3 REFERENCE STANDARDS

A. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment; Revision E, 2005.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. TIA-568.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; 2009c, with Addendum (2016).

D. TIA-606 - Administration Standard for Telecommunications Infrastructure; 2017c.

E. TIA-607 - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2019d.

F. UL 444 - Communications Cables; Current Edition, Including All Revisions.

G. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

B. Field Test Reports.

1.5 QUALITY ASSURANCE

A. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 PRODUCTS

2.1 PATHWAYS

A. Provide 1-1/4" conduit to above ceiling space. Provide protective bushing above ceiling space, and then run cabling back to data rack utilizing J-hooks every 4'-0" O.C.

2.2 COPPER CABLE AND TERMINATIONS

A. Manufacturers:

1. CommScope
2. General Cable Technologies Corporation
3. Siemon Company

B. Copper Horizontal Cable:

1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568.2 and listed and labeled as complying with UL 444.
2. Cable Type - Data: TIA-568.2 Category 6 UTP (unshielded twisted pair); 23 AWG
3. Cable Capacity: 4-pair.
4. Cable Applications: Use listed NFPA 70 Type CMP plenum cable unless otherwise indicated.

C. Speaker Wire and Cable: 18/2 copper conductor, 300 volt insulation, rated 60 degrees C, paired conductors twisted together shielded and covered with a PVC jacket.

2.3 COMMUNICATIONS EQUIPMENT ROOM FITTINGS

A. Copper Cross-Connection Equipment:

1. Patch Panels for Copper Cabling: Sized to fit EIA/ECA-310 standard 19 inch (482.6 mm) wide equipment racks; 0.09 inch (2.2 mm) thick aluminum; cabling terminated on Type 110 insulation displacement connectors; printed circuit board interface.
    a. Jacks: Non-keyed RJ-45, suitable for and complying with same standard as cable to be terminated; maximum 48 ports per standard width panel.
    b. Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.
    c. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606.
    d. Provide incoming cable strain relief and routing guides on back of panel.

2.4 COMMUNICATIONS OUTLETS

A. Outlet Boxes: Comply with Section 26 0533.16.

1. Provide depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.

B. Wall Plates:

1. Comply with system design standards and UL 514C.

2. Accepts modular jacks/inserts.

3. Wall Plate Material/Finish - Flush-Mounted Outlets: Match wiring device and wall plate finishes specified in Section 26 2726.

2.5 GROUNDING AND BONDING COMPONENTS

A. Comply with TIA-607.

2.6 IDENTIFICATION PRODUCTS

A. Comply with TIA-606.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

A. Comply with Communication Service Provider requirements.

B. Grounding and Bonding: Perform in accordance with TIA-607 and NFPA 70.

3.2 INSTALLATION OF PATHWAYS

A. Install pathways with the following minimum clearances:

1. 48 inches (1220 mm) from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.

2. 12 inches (300 mm) from power conduits and cables and panelboards.

3. 5 inches (125 mm) from fluorescent and high frequency lighting fixtures.

4. 6 inches (150 mm) from flues, hot water pipes, and steam pipes.

B. Conduit, in Addition to Requirements of Section :

1. Arrange conduit to provide no more than the equivalent of two 90 degree bend(s) between pull points.

2. Conduit Bends: Inside radius not less than 10 times conduit internal diameter.

C. Outlet Boxes:

1. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of telecommunications outlets provided under this section.

a. Mounting Heights: Unless otherwise indicated, as follows:

1 Telephone and Data Outlets: 18 inches (450 mm) above finished floor.

b. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.

3.3 INSTALLATION OF EQUIPMENT AND CABLING

A. Cabling:

1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.

2. Do not over-cinch or crush cables.

3. Do not exceed manufacturer's recommended cable pull tension.

4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.

B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:

1. At Distribution Frames: 120 inches (3000 mm).

C. Copper Cabling:

1. Category 5e and Above: Maintain cable geometry; do not untwist more than 1/2 inch (12 mm) from point of termination.

2. For 4-pair cables in conduit, do not exceed 25 pounds (110 N) pull tension.

3. Use T568B wiring configuration.

D. Identification:

1. Use wire and cable markers to identify cables at each end.

2. Use manufacturer-furnished label inserts, identification labels, or engraved wallplate to identify each jack at communications outlets with unique identifier.

3. Use identification nameplate to identify cross-connection equipment, equipment racks, and cabinets.

3.4 FIELD QUALITY CONTROL

A. Comply with inspection and testing requirements of specified installation standards.

B. Visual Inspection:

1. Inspect cable jackets for certification markings.

2. Inspect cable terminations for color coded labels of proper type.

3. Inspect outlet plates and patch panels for complete labels.

C. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Removal and reinstallation of existing fire alarm system components, to include all necessary wiring, and conduit extensions/modifications.

B. Additional initiation devices and notification appliances to accomodate renovations.

1.2 REFERENCE STANDARDS

1.3 SUBMITTALS

A. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation. Refer to Contract Drawings for additional requirements.

1. Copy (if any) of list of data required by authority having jurisdiction.

2. NFPA 72 "Record of Completion", filled out to the extent known at the time.

B. Data sheets for all proposed fire alarm components including but not limited to pull stations, fire alarm relays, heat detectors, smoke detectors, annunciation appliances and addressable relays

C. Revised battery circuit calculations for all NAC circuits modified (added to or subtracted from) as a result of the project modifications.

D. Summary of programming modifications performed

E. Voltage drop calculations per NFPA 72

1. Submit NFPA 72 "Inspection and Test Form," filled out.

F. Project Record Documents: Have one set available during closeout demonstration:

1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.

2. "As installed" wiring and schematic diagrams, with final terminal identifications.

3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

4. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.

5. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.

1.4 WARRANTY

A. Provide manufacturer's warranty for any system components other than wire and conduit installed as part of this project. Term shall be 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Existing Fire Alarm Control Units : Honeywell- Gamewell.

2.2 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide modifications and extensions to the existing automatic fire detection and alarm system:

1. Existing system: Simplex
2. Provide all components necessary, regardless of whether shown in Contract Documents or not.
3. Coordinate all work with facility fire alarm vendor- Simplex/JCI.
4. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
   a. ADA Standards.
   b. The requirements of the local authority having jurisdiction.
   c. Applicable local codes.
   d. Contract Documents (drawings and specifications).
   e. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.

B. Circuits:

1. Match exisitng configuration, class and style.

2.3 EXISTING COMPONENTS

A. Clearly label components that are "Not In Service."

B. Remove unused existing components and materials from site and dispose of properly.

2.4 FIRE SAFETY SYSTEMS INTERFACES

A. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:

1. Generator room heat detector.
2. Duct smoke detectors.
3. Heat/Smoke detectors

2.5 COMPONENTS

A. General:

1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Initiating Devices:

1. Manual Pull Stations: Provide pull stations compatible with exisitng FACP..

2. Smoke Detectors: Provide detectors compatible with the existing FACP.

a. Provide 5 extra.

3. Heat Detectors: Provide detectors compatible with the existing FACP.

a. Provide 5 extra.

C. Notification Appliances:

1. Speaker/Strobes: Provide appliances that are compatible with existing FACP.

2. Strobes: Provide appliances compatible with the existing FACP.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.

B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

C. Install instruction cards and labels.

3.2 INSPECTION AND TESTING FOR COMPLETION

A. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

B. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

C. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

D. Provide all tools, software, and supplies required to accomplish inspection and testing.

E. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

F. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.3 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.

1. Be prepared to conduct any of the required tests.

2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.

3. Have authorized technical representative of control unit manufacturer present during demonstration.

4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Outline of sitework included.
2. General Job Conditions/Special Conditions.
3. Layout, lines, levels, and field checks.
4. Protection of work areas and existing items to remain.
5. Clearing and grubbing.

B. Related Work Specified Elsewhere:
1. Section 31 1000 – Site Clearing
2. Section 31 1001 – Site Preparation
3. Section 31 1413 – Topsoil
4. Section 31 2213 – Rough Grading
5. Section 31 2216 – Fine Grading
6. Section 31 2300 – Excavation, Backfilling and Compacting
7. Section 31 2500 – Erosion, Sediment and Pollution Control
8. Section 32 1100 – Base Courses
9. Section 32 1216 – Asphalt Pavement
10. Section 32 1313 – Site Concrete
11. Section 32 1723 – Pavement Markings
12. Section 32 3113 – Chain Link Fencing
13. Section 32 4000 – Site Improvements
14. Section 32 9200 – Lawns
15. Section 32 9300 – Plantings
16. Section 33 4000 – Storm Drainage
17. Section 33 4001 – Underground Stormwater Retention System

PART 2 - NOT USED

PART 3 - EXECUTION

3.01 SITEWORK INCLUDED

The work includes all labor, materials, plantings, equipment, and related construction services necessary to furnish and install all sitework required for each school site(s) as delineated on the Bid Form, as shown on the drawings, and in accordance with these specifications. Work includes but is not limited to the following:

A. Site Preparation and Earthwork:
1. Erosion and sedimentation control devices and measures.
2. Removal of existing paving, curbing, walls, storm sewer system components, trees and vegetation, including any salvaging and stockpiling of items indicated for reuse or for future use.
3. Stripping and stockpiling of topsoil; soil tests.
4. Excavation, trenching, grading, filling, backfilling, and related earthwork with compaction to establish subgrades under fields, paving, curbs, walls, drainage facilities, related structures and improvements, and lawn and other vegetation areas.
5. Spreading and grading of topsoil. (Also see Item E below.)
6. Removal of rubble, excess or unsuitable excavated soils, rubble, debris and other materials from site.

B. Piped Utilities
1. Storm Drainage: Catch basins, manholes, culverts, drywells, drain inlets, underdrains, stormwater management facilities and related storm drainage improvements.

C. Paving and Surfacing with any Related Structures:
1. Asphalt concrete paving with pavement markings.
2. Concrete paving, curbs, ramps and other structures

D. Site Improvements
1. Signs.

2. Chain link fence with gates

E. Lawns and Plantings:
1. Topsoil fine grading, amendment and related work.
2. Seeding/establishment of lawn and other grasses.
3. Tree/shrub plantings

3.02 GENERAL JOB CONDITIONS

A. Schedule and conduct work to permit access to adjoining Owner and other properties and facilities at all times and in accordance with any phasing requirements of the contract. Do not impede access by emergency vehicles and forces. Notify and coordinate with Owner in advance of work and in advance of limiting or detouring access to or use of any other facilities. Approximate limits of work are as shown or implied on drawings; do not intrude onto other site areas more than reasonably necessary for access, staging, storage and other incidental aspects of work.

B. Verify all existing lines, limits, distances, dimensions, elevations, and other conditions affecting work required. Comply with special instructions on drawings. Notify Architect immediately of any conditions encountered which appear to be inconsistent with work requirements, so that such matters may be resolved. Verify any existing underground utility locations and conditions prior to excavation; contact and secure Dig Safely New York (DSNY) services as required (CALL811). Excavate carefully in all locations close to known or likely underground utility lines.

C. In addition to all requirements of the General Conditions and all other public safety regulations and requirements applicable to the work, exercise caution in all sitework access and operations in anticipation that public pedestrian and vehicular traffic and activity will occur in proximity to the work and to access routes to and from the work at all times.

D. Contractor is held to have visited site and to have identified, investigated and measured surface and subsurface conditions and quantities involved in and affecting the scope, complexity and cost of the work prior to submission of a bid. Contractor may, for his information, make test excavations during bidding period. Contact Architect for approval prior to any such excavation and repair test holes as directed.

Contractor shall use his own judgment in interpreting all surface and subsurface conditions; no responsibility is assumed by Owner or Architect for survey information, lack of survey information, or actual conditions encountered. Any geotechnical evaluation reports with soil test boring and pit logs, descriptions and related data and recommendations on existing subsurface and construction conditions included in the contract documents are made available for the convenience of the Contractor. If included, such reports are not intended as a representation or warranty of the accuracy of such information or the continuity of conditions between any soil boring and test pit locations. It is expressly understood that the Owner and Architect shall not be responsible for interpretations or conclusions drawn from the reports by the Contractor. Claims for extra compensation or inability to perform work in accordance with Contract Documents, or for an extension of time will not be considered for any alleged or actual differences between site surface or subsurface conditions and such information and data, except as may be provided elsewhere in the Contract Documents. Owner may elect alternative methods of accomplishing work in the event that variations in sitework conditions or unknown conditions are encountered.

E. Avoid spills and littering of earth, rubble or other debris on Owner or other public streets or other roadways; clean up any spills promptly and regularly.

F. Notify Architect in writing of any existing damage to "items to remain" prior to commencing work.

G. Highway Work Permit: A portion of the proposed sitework occurs within either a Town or County highway right-of-way. The sitework contractor is responsible for completing any necessary Highway Work Permits for any work within the right-of-way and providing necessary insurances. The district will pay any permit application fees. Coordinate work with Construction Manager.

3.03 LAYOUT, LINES, LEVELS, AND FIELD CHECKS

A. Employ licensed Engineer or Surveyor to stake out all work.

B. Set hubs, offset lines, and grade stakes where spot elevations are shown, at breaks in grade, and as otherwise required.

C. Run lines from existing buildings, monuments, and features shown on drawings. Establish base lines. Mark well and protect during construction. Run levels from benchmarks. Verify benchmark elevations. Advise Architect of results before commencing work.

D. Accurately locate all new buildings, roads, paved areas, walks, features, etc. Advise Architect of any discrepancies, prior to commencing work.

3.04 PROTECTION

A. Plank all walks, pavements, and curbs to be crossed by equipment.

B. Protect Persons and Property: provide temporary fencing, barricades, signs, signals, and other measures and devices for protection of persons, property, existing improvements to remain and traffic and other activities in and adjoining the site of the work, in accordance with all applicable laws and regulations, at all times during work.

When work areas are to be unattended, check that open excavations or other unsafe areas or conditions are adequately barricaded and that signals are operative.

Perform work to prevent erosion, flooding, undermining, lateral movement, settlement, or other instability or damage of adjoining areas of the site and adjoining improvements. Make certain that cut or fill embankments slopes are stable during overnight or other periods of work interruption.

Contractor shall include in their bid, the cost of installing and maintaining for the duration of the project, 2,000 linear feet of (4) four foot high orange construction fence). The construction fence will be installed as directed by the Construction Manager. The fence may be installed across both lawn and paved surfaces mounted on temporary posts or stakes as may be required.

C. Protect Utilities: Protect and preserve in operating condition all active surface and subsurface utilities indicated on the drawings or which may otherwise exist or be encountered within or adjacent to the work. Excavate carefully near any known or suspected utility lines. Cooperate with other contractors performing removals or replacements of utilities. Particularly note the instructions on the drawings to verify location and/or depth of certain utility lines. Secure DSNY services to locate utilities.

Damage to any utility lines or structures resulting from work shall be repaired by at the expense of the contractor, to the satisfaction of the Owner, Architect, utility company or other authority having jurisdiction.

If active utilities are cut, broken, or damaged during work, immediately take all steps necessary to avoid endangering persons or property. Notify Owner, Architect and affected utility company or other jurisdiction to obtain a decision and/or assistance in repair of damaged facilities.

Remove, plug or cap as required any active and abandoned utilities encountered during construction operations or shown on drawings. If contractor is required to reroute/replace any portions of existing active utility lines, determine connection points and otherwise plan work in advance so that service is interrupted as briefly as possible. Where existing lines are to be abandoned, remove any portions which may interfere with or may be unstable or prone to settle under or along new structures or pavements. Refer to drawings. Other portions may be abandoned in-place.

In the event that water, storm sewer, sanitary sewer, or other utility lines are broken, or that springs, ground water, or other sources of water are encountered, necessary steps are to be taken immediately in order to divert water to prevent erosion, undermining or other damage to existing improvements or construction operations. Permanent replacement, reconstruction or other corrective measures are the contractor's responsibility. Methods subject to approval of architect and others having jurisdiction.

D. Protect Trees: protect all trees and shrubs in and adjoining work areas which are not identified to be removed. Do not store or stockpile earth or other materials or equipment and do not operate heavy equipment more than necessary within the branching limits of trees.

3.05 CLEARING AND GRUBBING

A. Unless otherwise noted on the drawings, remove promptly from site and legally dispose of all trees, logs, stumps, roots, brush, vegetation, rubbish, stones, boulders and other objectionable or perishable materials within grading limits to 1'-6" below finish grade or to original grade whichever is the greater depth.

B. No burning of any cleared and grubbed material shall be permitted.

3.06 BASE BIDS AND STATE CONTRACTS

A. Sitework Contract Base Bid: All sitework shown on the Sitework Contract drawings except sitework identified on the drawings as to be provided under separate state contract.

END OF SECTION 31 1001

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Rough grading.

B. Related Sections:
   1. Section 31 2216 - Fine Grading
   2. Section 31 2300 - Excavation, Backfilling and Compacting

PART 2 - PRODUCTS

(Not Applicable)

PART 3 - EXECUTION

3.01 ROUGH GRADING

A. Subgrade: Depth below finished grade as required for topsoil or pavement.

B. Accuracy: Set grade stakes where spot elevations are shown, at breaks in grade, along drainage "swales" and as otherwise required to correctly grade the area according to elevations shown on plans.

C. Completion of rough grading: Obtain Architect's approval before spreading topsoil or preparing pavement subgrade.

D. Subgrade rolling: All paved areas. In areas inaccessible to roller, use mechanical tamps. Refer to Section 31 2300, Excavation, Backfilling and Compacting for compaction requirements.

E. Avoid excessive working of subgrade or use of equipment that causes pumping or weaving.

END OF SECTION 31 2213

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Topsoil spread
   2. Fine grading of paved and unpaved areas

B. Related Sections:
   1. Section 31 1413 - Topsoil
   2. Section 31 2213 - Rough Grading

PART 2 - PRODUCTS

2.01 MATERIALS

A. Topsoil as specified in Section 31 1413.

PART 3 - EXECUTION

3.01 SPREAD TOPSOIL

A. Entire unpaved area within contract limits, unless otherwise noted.

B. Spread, compact and manipulate topsoil to a minimum thickness as detailed after compaction to smooth draining grades true to elevations shown or indicated on drawings. Generally, all areas shall receive 4-inch topsoil thickness, plant beds shall receive 18 inch minimum topsoil thickness. Refer to drawings for verification and any special requirements for use of stripped topsoil.

C. Excess topsoil: Excess topsoil is the property of the owner. Excess topsoil shall remain in the approved topsoil stockpile area.

3.02 FINE GRADE OUTSIDE BUILDING LINES

A. Disk or harrow 4-inch depth where topsoil has been spread and 4 inch depth in disturbed areas where no grade change occurs.

B. Remove all stones 1 inch diameter and larger, roots, rubbish and all other foreign matter.

C. Grade to exact well draining grades indicated. Maximum allowed tolerances:
   1. Unpaved areas – grade surface areas to receive lawn or plantings to a tolerance of plus or minus 0.10 foot. Swales and ditches to a tolerance of plus or minus 0.05 foot.
   2. Paved areas - shape subgrade for pavement to a tolerance of plus or minus 0.05 foot.
   3. Exterior steps and ramps - finished subgrade to a tolerance of plus or minus 0.05 foot.

END OF SECTION 31 2216

EXCAVATION, BACKFILLING AND COMPACTING 31 2300

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Excavation.
   2. Filling and backfilling.
   3. Stabilization fabric.
   4. Sand and fill materials.
   5. Compaction requirements.

B. Related Sections:
   1. Section 31 2213 - Rough Grading
   2. Section 31 2216 - Fine Grading
   3. Section 32 1100 - Base Courses

1.02 EXAMINATION OF EXISTING GRADES

A. Examine grades and notify Architect of discrepancies, if any, before proceeding. Start of work implies acceptance of existing grades.

1.03 SUBMITTALS

A. Material Certificates (MC) including a certified laboratory sieve analysis (LA) bearing name and location of quarry. Sample (S) of material required (approximate volume 1 cu. ft.) in a waterproof container permanently labeled to show source. Submit for the following materials:
   1. Subbase Material: (MC), (LA) including moisture/density curves and (S)
   2. Coarse Aggregate Fill: (MC) and (S)
   3. Drainage Fill (#1 Crushed Stone): (MC), (LA) and (S)
   4. Drainage Sand: (MC) and (S)

B. Manufacturers data (MD) and product sample (S) required for the following materials:
   1. Stabilization Fabric: (MD) and (S)

1.04 SETTLEMENT

A. Repair to proper grade any slab, pavement, utility, structure or lawn adversely affected by settlement or heaving within two-years after the date of substantial completion at no expense to the owner.

1.05 TIMING

A. Install drainage system prior to or concurrent with road excavation to prevent/limit downstream flooding and erosion/sedimentation, to allow trench or general fill settlement, and to allow installation of subbase materials for construction.

1.06 GENERAL DEWATERING

A. The Contractor shall dewater all excavations when water has entered the excavation or at the direction of the Engineer. The Contractor shall provide all equipment necessary to complete the work.

1.07 USAGE OF ELECTRONIC DOCUMENTS FOR MACHINE CONTROL EQUIPMENT

A. The contractor may use any type of GPS machine control equipment and systems that results in achieving the proposed grading requirements. The contractor shall convert the electronic data provided by the Architect into the format required by their system.

B. No guarantee is made that the data systems used by the architect will be directly compatible with the systems used by the contractor.

C Contractor understands that any manipulation of the electronic data provided by the architect shall be at their own risk. The electronic documents are provided as a convenience to the contractor in connection with the contractor's responsibilities and obligations relating to the project. The owner and Architect shall not be construed to have performed any services in connection with the Contractor's use of the electronic files provided and shall have no liability for any aspect of their use, and has no contractual relationship in connection to their use, other than set forth herein.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General Fill (Excavated Subsoil/Soil Fill): Approved, free of frost, trash, stumps, trees, roots, sod, muck, etc. If suitable excavated material is insufficient to meet fill requirements, furnish additional material at contractor's expense, subject to approval by architect. Thoroughly break up and condition soils for layered placement and compaction in fill areas.

B. Drainage Fill (#1 Crushed Stone): Crushed stone or washed crushed gravel. Clean, durable, of uniform quality throughout.

Standard ASTM Sieve Size	Percent Passing by Weight
1 inch (25 mm)	100
1/2 inch (12.5 mm)	90-100
1/4 inch (6.3 mm)	0-15

C. Stabilization Fabric: Polypropylene fiber Mirafi Celanese Fibers 500x, Amoco 2002, Carthage Mills FX-55 or approved equal.

D. Coarse Aggregate Fill: Clean run-of-bank gravel, 3" maximum size. Able to be compacted to compaction standards herein and free from organic and other deleterious materials. Where any such fill is deeper than 24 inches, a coarser, well-graded run-of-bank material with particle sizes ranging up to 6-inches may be used in the lower layers.

Standard ASTM Sieve Size	Percent Passing by Weight
1/4 inch (6.3 mm)	30-100
No. 40 (.425 mm)	0-70
No. 200 (.075 mm)	0-10

E. Subbase Course Material: Crushed limestone conforming to NYSDOT Section 304-2.02 Subbase Course Type 2 well graded from coarse to fine to produce tightly bonded material when compacted, and free from soil, organic materials or other contamination.

Standard ASTM Sieve Size	Percent Passing by Weight
2 inch (50 mm)	100
1/4 inch (6.3 mm)	25-65
No. 40 (.425 mm)	5-40
No. 200 (.075 mm)	0-10

F. Drainage Sand: Clean, free draining, well graded, coarse manufactured or natural sand, free of organic materials, conforming to (ASTM C33) meeting the following gradation:

Standard ASTM Sieve Size	Percent Passing by Weight
3/8 inch (9.5 mm)	100
No. 4	95-100
No. 8	80-100

No. 16	50-85
No. 30	25-60
No. 50	5-30
No. 100	0-10
No. 200 (.075 mm)	0-3

G. Topsoil: Refer to Section 31 1413 - Topsoil.

PART 3 - EXECUTION

3.01 GENERAL

A. Banks and sides: Angle of recline or sheathing, shoring, and bracing as required for safety and conforming to all applicable laws, rules, regulations and codes.

B. Protection: Provide lights and barricades to properly protect persons and property. Assume full responsibility for all accidents during the course of work.

3.02 UNCLASSIFIED EXCAVATION

A. Includes all earth and miscellaneous material encountered.

B. Cut to exact elevations and grade. If soil becomes saturated and loses its structure in an area, cease work in that area, after establishing positive surface drainage, until surface dries. When the area has stabilized, continue excavation. Transport to fill areas.

C. Excess excavated material and excavated material not suitable for use as general fill may be placed in on-site fill area. Location and placement methods to be approved.

D. If stockpiled, pile in manner and location that will not impede the work of any other contractor, as directed by the Construction Manager (CM).

E. Excavation Classifications - The following classifications of excavations will be made when rock is encountered:
1. Earth excavation includes excavation of pavements and other obstructions visible on surface: underground structures, utilities, and other items indicated to be demolished and removed: together with earth and other materials that are not classified as rock excavation.
2. Rock excavation for trenches and pits includes removal & disposal of materials and obstructions encountered that cannot be excavated with a track-mounted power excavator, equivalent to Caterpillar Model No. 215c LC, and rated at not less than 115 HP flywheel power and 32,000-pound drawbar pull and equipped with a short stick and a 42 inch wide, short tip radius rock bucket rated at 0.81 cubic yard (heaped) capacity. Trenches in excess of 10 feet in width and pits in excess of 30 feet in either length or width are classified as open excavation.
3. Rock excavation in open excavation includes removal and disposal of materials and obstructions encountered that cannot be dislodged and excavated with modern track mounted, heavy duty excavating equipment without drilling, blasting, or ripping. Rock excavation equipment is defined as caterpillar model No. 973 or equivalent track mounted loader, rated at not less than 210 HP flywheel power and developing minimum of 45,000- pound breakout force (measured in accordance with SAE J732).
    a. Typical of materials classified as rock are boulders ½ cu. yard or more in volume, solid rock, rock in ledges, and rock hard cementitious aggregate deposits.
    b. Intermittent drilling or ripping performed to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation.

F. Do not perform rock excavation work until material to be excavated has been cross sectioned and classified by architect. Such excavation will be paid on basis of contract conditions relative to changes in work.

G. Rock payment lines are limited to the following:
1. Two feet outside of concrete work for which forms are required, except footings.
2. One foot outside perimeter of footings.
3. In pipe trenches, 6 inches below invert elevation of pipe and 2 feet wider than inside diameter of pipe, but not less than 3-foot minimum trench width.
4. Outside dimensions of concrete work where no forms are required.
5. Under slabs on grade, 6 inches below bottom of concrete slab.

3.03 UNCLASSIFIED EXCAVATION FOR STRUCTURES

A. Includes all earth and miscellaneous material encountered.

B. Excavate to depth as shown on drawings. Transport to fill areas.

C. Excess depth: Backfill to proper elevations with Coarse Aggregate Fill at Contractor's expense.

D. Clearance sufficient for form work to be performed. Banks and sides - angle of recline or sheeting, shoring, and bracing as required for safety and conforming to all applicable laws, rules, regulations and codes. Remove before backfilling.

E. Remove loose material and debris from excavation so all footings rest on solid, undisturbed soil.

F. Remove water during excavation for foundations by ditching or pumping so that no water stands.

G. Insure that movement of equipment in the excavation does not cause working and pumping of the underlying soil which is not to be excavated. Should the equipment used cause excessive working, use other methods of excavation to maintain the design bearing capacity of the soil.

3.04 UNCLASSIFIED TRENCH EXCAVATION

A. Includes all earth and miscellaneous material encountered.

B. Excavate to exact depth and grade allowing clearance for pipe bedding as required.

C. Transport excess to fill areas.

D. Report wet or unstable trench bottom to Architect. Should Architect deem unsuitable, excavate to depth as directed and backfill with #1 crushed stone to trench bottom or as otherwise directed.

E. Do not excavate over 12 inches wider than outside diameter of pipe below spring line.

F. Pump as required to dewater excavation.

3.05 GENERAL FILLING REQUIREMENTS

A. Start after approval by Architect.

B. The subgrade to receive fill shall be firm and stable and should not exhibit mud, organic material, topsoil, standing water, debris or frozen material. Where applicable, subgrade should be proof-rolled and remediated (if necessary). Approved subgrade should be immediately protected by placement of the planned fill.

C. Fill material shall be placed on a satisfactory and approved subgrade in a manner to minimize segregation. The fill should be placed in nearly horizontal lifts commencing at the lowest fill area elevation and proceeding with each lift upward and outward from the lower lift. The moisture content of the material shall be adjusted prior to application of compaction such that it is within 2% of the Optimum Moisture Content. The first lift shall be placed to a loose thickness not to exceed 8 inches (12" in mass fill areas). This first lift shall then be compacted to an in-place density not to less than 95% of the maximum dry density, unless noted otherwise in this specification section.

D. No subsequent lift shall be placed until the underlying lift has been adequately compacted to a stable and uniform mass.

E. All subsequent lifts shall not exceed 8 inches (12" in mass fill areas) in compacted thickness, shall be moisture conditioned prior to compaction to within 2% of Optimum Moisture Content, and shall be compacted uniformly to an in-place field density of not less than 95% of Maximum Dry Density, unless noted otherwise in this specification section.

F. When the test results indicate that insufficient compaction has been obtained in any layer, the Contractor shall take such action as the engineer may direct to modify or alter the moisture content of the soil, to provide additional compaction or otherwise to increase the in-place soil density. If the contractor cannot obtain satisfactory compaction due to material properties, he shall remove the unsatisfactory material and replace with new material. Materials contaminated by mud, debris, organics and/or any other deleterious materials shall be removed and replaced with uncontaminated specified material.

G. Where a structural fill abuts an existing earthen embankment or slope, each lift shall be stepped or benched into the existing slope and each subsequent lift shall overlap appropriately (at least 12 inches) the underlying step or bench.

H. Each lift and the final grade shall be graded or sloped to promote positive drainage off the fill and out of the limit lines. The extent of backfill and fill, upon completion, shall conform to the lines and grades given on the plans.

3.06 TRENCH BACKFILL

A. Materials:
1. Under lawns and under planting beds: Approved excavated subsoil material.
2. Under pavements: Subbase material or coarse aggregate fill, refer to drawings.

B. Start after approval of Architect.

C. Place: Do not place on frozen ground. Place in 6 inch layers from cushion sand or filter material to subgrade. No boulders or stones over 4 inches. Tamp each 6 inch layer with mechanical tamper. Adjust fill to smooth subgrade.

D. Compaction: Uniformly spread each layer, moisten or dry as required, and then compact so unit dry weight of the compacted material meets or exceeds 95% of the maximum modified proctor density based on ASTM D1557 procedures.

3.07 FILL AT STRUCTURES

A. Materials:
1. Fill under pavement subgrade - coarse aggregate fill or subbase course material.
2. Site structures backfill to subgrade where pavement occurs and no footing drains occur - coarse aggregate fill.
3. Demolition backfill to subgrade where no pavements occur - excavated subsoil material.
4. Demolition backfill to bottom of new construction where pavements occur - coarse aggregate fill.

B. Start after approval by Architect.

C. Place: Do not place on frozen ground. Place in 6 inch layers. Compact by approved mechanical equipment. Remove construction debris from excavation.

D. Compaction: Uniformly spread each layer, moisten or dry as required, and then compact so unit dry weight of the compacted material meets or exceeds 95% of the maximum modified proctor density based on ASTM D1557 procedures.

3.08 STABILIZATION FABRIC

A. Place Stabilization fabric in lengths and widths as large as possible. Lap seams per manufacturer's instructions or 6 inches minimum.

B. Cover using methods that will not damage or displace stabilization fabric.

C. Time operations to avoid trenching by any contractor in areas where stabilization fabric has been placed.

3.09 EXCESS EXCAVATED MATERIAL

A. All excess earth excavated material not required to meet on site fill requirements shall be promptly removed from the site and legally disposed of at contractor's expense, unless otherwise noted on the plans.

3.10 FIELD QUALITY CONTROL

A. Proof-rolling - immediately prior to placing general base material for pavements or slabs on grade, proof-roll subgrade with 10 ton minimum loaded smooth drum self- propelled vibratory roller. Undercut all areas which show pumping or weaving and replace with acceptable fill materials compacted to 95% of the maximum modified proctor density based on ASTM D1557 procedures.

B. Quality Control Testing during Construction:
1. Owner shall provide and pay for services of independent testing service to inspect and test final cut and fill subgrades, utility trenching and subbase course compaction prior to paving. Additional tests will be taken as required for full coverage of paved areas.
2. Provide timely notice to Architect to inspect and approve subgrades and fill layers before further construction work is performed.
3. Compaction: ASTM D1557, latest edition: 1 test initially and 1 test for each significant change in fill material.
4. Field density or in place density tests: Sand-cone method or other method approved by Architect in accordance with ASTM D1556, latest edition.
   a. Trench Backfill
      One test for each 20 linear feet of trench and for each two feet vertical depth of backfill. Architect may require additional tests to verify results of each test which fails to meet results specified. If tests verify compaction below that specified, recompact and/or remove, replace and retest material at the same rate until specified compaction is achieved.
   b. Paved Areas

At least 1 test for each 2,000 square feet of paved area. Architect may require additional tests to verify results of each test which fails to meet results specified. If tests verify compaction below that specified, remove, replace and retest material at the rate of one test per 1000 square feet of paved area until specified compaction is achieved.

3.11 DEWATERING

A. Details of the dewatering are left to the Contractor's discretion. The Contractor shall submit a dewatering plan of his proposed dewatering system to the Engineer for review. No excavation in the wet shall proceed until the Contractor receives notice the review of the dewatering plan has been completed by the Engineer.

B. The Contractor shall at all times during construction, provide and maintain proper and satisfactory means and devices for the removal of all water entering the excavations, and shall remove all water as fast as it may collect, in such manner as shall not interfere with the prosecution of the work or the proper placing of soil, granular material, sewers, concrete, masonry or other work.

C. Removal of water includes the construction and removal of cofferdams, sheeting and bracing, the excavation and maintenance of ditches and sluice-ways, furnishing and operation of pumps, well points, and furnishing all labor, material and equipment needed to maintain thorough drainage of the work in a satisfactory manner.

D. Water shall not be allowed to rise over or come in contact with any masonry, concrete or mortar and no water shall be allowed to flow over such work until such time as the Engineer may permit.

E. Water pumped or drained from excavations, or any sewers, drains, or water courses encountered in the work, shall be disposed of in a suitable manner without injury to adjacent property, the work under construction, to pavements, roads and drives and must comply with the requirements of the Stormwater Pollution Prevention Plan. No water, including sediments, shall be discharged to sanitary sewers, adjoining properties, water courses or wetlands. Any damage caused by improper handling of water shall be repaired by the Contractor at his own expense.

3.12 REMOVAL OF CONTAMINATED MATERIAL

A. Contractor shall be responsible for excavation and removal from the site of any soils or other materials which become contaminated by spills or dumping on the site of petroleum, solvent, chemical or other hazardous products and materials occurring during and as a result of the work of the contractor or any subcontractor, as observed and ordered by the Owner, Architect or others having jurisdiction. Contractor shall bear the cost of such work and any fees, fines, penalties or other costs levied against any parties by agencies having jurisdiction. Excavation, removal, storage and disposal of such contaminated materials shall be conducted in accordance with all applicable laws and regulations, including notification and other requirements of the New York State Department of Environmental Conservation and other agencies having jurisdiction. Replacement of removed materials shall be consistent with original material, placement and compaction requirements, and related work.

END OF SECTION 31 2300

EROSION, SEDIMENT AND POLLUTION CONTROL 31 2500

PART 1 - GENERAL

1.01 SUMMARY

A. The extent of the erosion, sediment and pollution control is shown on the drawings.

B. Erosion, sediment and pollution control includes, but is not limited to the following:
1. Erosion, sediment and pollution control measures including silt fence, stone check dams and silt fence dikes.
2. Slope and swale protection.
3. Construction entrances.
4. Permanent and temporary seeding.

C. Related sections:
1. Section 31 1413 - Topsoil
2. Section 31 2213 - Rough Grading
3. Section 31 2216 - Fine Grading
4. Section 31 2300 - Excavation, Backfilling and Compacting
5. Section 33 4000 - Storm Drainage
6. Section 32 9000 - Lawns and Sod
7. Section 32 9300 - Plantings

1.02 QUALITY ASSURANCE

A. Conform to requirements of all regulatory authorities having jurisdiction.

1.03 REFERENCES

A. Guidelines for Erosion Control in Urban Areas of New York State.

B. New York State Stormwater Management Design Manual.

1.04 SUBMITTALS

A. Material Certificates (MC) and Sample (S) of material required for the following materials:
1. No. 4 Stone: (MC), (LA) and (S) provide 5 lb. sample
2. #1 Crushed Stone: (See Section 31 2300, Submittals)
3. Subbase Material: (See Section 31 2300, Submittals)
4. Select Granular Fill: (See Section 31 2300, Submittals)

B. Shop Drawing, Manufacturers data (MD) and product sample (S) for the following materials as noted below:
1. Stabilization Fabric for Construction Access Road: (MD)
2. Silt Fence: (MD)
3. Erosion Control Fabric: (MD)
4. Soil Separation Fabric: (MD)

C. Certifications (SPEDES Requirement): The contractor(s) responsible for project sitework shall submit a signed SWPPP certification page.

D. Construction Sequence Scheduling (SPEDES Requirement): The contractor is responsible for the completion of Schedule.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Silt fence:
1. Fabric - Mirafi 100X or equal.
2. Support - 14-1/2 gauge galvanized woven wire with maximum 6 inch mesh opening.
3. Stakes: rough sawn hardwood, pointed on one end. Minimum cross sectional area 3 square inches.

B. Construction Access Road (Mudrack):

1. Stabilization Fabric - Refer to Section 31 2300 - Excavation, Backfilling and Compaction.
2. Stone - No. 4 stone or crushed concrete.

C. No. 4 Stone:

Standard ASTM Sieve Size	Percent Passing by Weight
4 inch (100 mm)	100
3 inch (75 mm)	90-100
2 inch (50 mm)	0-15
Passing No. 50	5-10
Passing No. 100	2-5

D. Erosion Control Fabric:
1. Material - Mutual Industries or approved equal.
2. Woven jute (undyed and sun bleached)

E. Seeding: Refer to Section 32 9200.

PART 3 - EXECUTION

3.01 GENERAL

A. The contractor is responsible for controlling sediment from leaving the project site. Erosion control plan and erosion control details have been prepared for this project and shall be followed during construction.

B. Pollutants such as fuels, lubricants, bitumens, raw sewage, chlorine and other harmful materials shall be handled and disposed of by approved methods and shall not be discharged into rivers, streams, impoundments, wetlands, or into natural or man-made channels leading thereto. Wash water or waste from concrete mixing or curing operations shall not be allowed to enter live streams.

C. In case of repeated failures on the part of the Contractor to control pollution/erosion, the right shall be reserved by the Owner's representative to employ outside assistance to provide the necessary corrective measures. Such incurred costs, plus related engineering costs, shall be charged to the Contractor and appropriate deductions made to the Contractor's progress payment.

D. Any fines or fees incurred by the Contractor for failure to implement and maintain erosion control devices shall be paid for by the Contractor.

3.02 INSTALLATION OF EROSION CONTROL FACILITIES

A. Simultaneous with removal work and earthwork, install temporary erosion and sediment control facilities shown on drawings and all other facilities required initially and from time to time throughout the work as determined by the Contractor in accordance with Guidelines for Erosion Control in Urban Areas of New York State to prevent and reduce erosion and sedimentation affecting existing on-site improvements to remain or adjoining property or roadways.

B. To control erosion and sedimentation, initial construction operations shall include, as a minimum:
1. Silt fencing along all perimeters of work as may be shown on the drawings and other perimeters which could produce erosion and sedimentation affecting adjoining properties, roadways, water bodies, and other improvements and facilities.
2. Silt fencing around stockpiles of topsoil and other excavated soils.
3. Installation of Stabilized Construction Entrance (Mud Rack)

C. Temporary sediment traps installed by the Contractor shall be sized to provide, as a minimum, 3600 CF of storage capacity for each acre of area being drained or as indicated on plans.

D. Sediment shall be removed from temporary sediment basin and sediment swales and traps and along silt fences and straw bale dikes regularly to maintain stability, flow and storage capacity.

E. Throughout all building and site work, Contractor shall be responsible for erosion and sediment control and for planning, scheduling and

phasing work to prevent erosion or sedimentation. Drainage areas should be seeded and stabilized as soon as possible as other work is completed. Temporary seeding with Annual Rye may be considered if final seeding is delayed.

F. All facilities shall be removed as the contributory drainage areas are stabilized and as construction is to be completed. Restore all affected site areas and surfaces.

G. Maintain best management practices (BMP's) per SWPPP.

3.03 SLOPE PROTECTION

A. Protect all disturbed areas during and after earthwork operations as required to prevent gullying, mass wasting and erosion. Stabilize with erosion control fabric. Repair all eroded areas at no expense to the Owner.

3.04 SILT FENCE

A. Construct as detailed truly vertical for entire length. Install all contour 10 feet from toe of slope when practical.

B. Install where indicated on the drawings and/or as required. Wrap silt fence end posts together for continuous support in bed fabric; six inches minimum.

C. Bury Fabric 6 inches minimum.

D. Periodically maintain, remove sediment when 50% or greater full.

E. Promptly replace damaged or worn silt fence immediately.

3.05 STABILIZED CONSTRUCTION ENTRANCE

A. Install where indicated on the drawings and/or as required.

B. Construct as detailed from stone or crushed concrete from site demolition. Maintain at all times and renew when no longer effective. Remove when no longer being used.

C. The pavement adjacent to the entrance shall be swept daily to remove excess mud, dirt or rock tracked from the site.

D. Dump trucks hauling material from the site shall be covered with a tarpaulin.

3.06 INTERCEPTER DIKES & SWALE

A. Install per plan or as otherwise required to direct storm water runoff to temporary sediment traps and detention facilities.

B. Stabilize with erosion control fabric, seed or mulch.

C. Install stone check dams along swale line as detailed at two vertical foot intervals.

3.07 EXCAVATION DEWATERING

A. Install upstream and/or downstream berm as required.

B. Sediment-laden water shall be discharged to silt trapping device.

3.08 STONE CHECK DAM

A. Check Dam where indicated on the plans and as otherwise required by construction phasing.

B. Maintain Check Dam during duration of construction.

C. Remove silt when Check Dam

D. Remove after adjoining areas have been stabilized.

3.09 INLET PROTECTION

A. Contractor shall protect inlet, end sections and other outlets using appropriate Best Management Practice. Best Management Practices

include Block and Gravel drop inlet protection, filter fabric inlet protection and excavated drop inlet protection as acceptable control devices.

END OF SECTION 31 2500

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Subgrade preparation
   2. Stabilization fabric
   3. Subbase course
   4. Coarse aggregate fill

B. Related Sections:
   1. Section 31 2213 - Rough Grading
   2. Section 31 2216 - Fine Grading
   3. Section 31 2300 - Excavation, Backfilling and Compacting

1.02 SUBMITTALS

A. Material Certificates (MC) including a certified laboratory sieve analysis (LA) bearing name and location of quarry. Sample (S) of material required (approximate volume 1 cu. ft.) in a waterproof container permanently labeled to show source. Requirements for the following materials:
   1. Subbase Material: (See Section 31 2300 - Excavation, Backfilling and Compacting Submittals)
   2. Coarse Aggregate Fill: (See Section 31 2300 - Excavation, Backfilling and Compacting Submittals)
   3. Drainage Fill (#1 Crushed Stone): (See Section 31 2300 - Excavation, Backfilling and Compacting Submittals)

B. Manufacturers data (MD) and product sample (S) required for the following materials:
   1. Stabilization Fabric: (Refer to Section 31 2300 - Excavation, Backfilling and Compacting Submittals)

PART 2 – PRODUCTS

2.01 BASE COURSES

A. Subbase Course Material: Refer to Section 31 2300 - Excavation, Backfilling and Compacting.

B. Coarse Aggregate Fill, Backfill and Foundation Material: Refer to Section 31 2300 - Excavation, Backfilling and Compacting.

C. Excavated Subsoil: Refer to Section 31 2300 - Excavation, Backfilling and Compacting.

2.02 STABILIZATION FABRICS

A. Stabilization Fabric: Refer to Section 31 2300 - Excavation, Backfilling and Compacting.

PART 3 – EXECUTION

3.01 SUBGRADE PREPARATION

A. Grade to smooth draining grades parallel to finish grade and to proper subgrade elevations. No humps or hollows. Proofroll immediately prior to placing general base material for pavements or slabs on grade, proofroll subgrade with 7 ton minimum loaded smooth drum self-propelled vibratory roller. Undercut all areas which show pumping or weaving and replace with acceptable fill materials compacted to 95% of the maximum modified proctor density based on ASTM D1557 procedures. Avoid overworking subgrade and running equipment on subgrade unnecessarily. If an area becomes saturated and loses its structure, discontinue working, facilitate surface and subsurface drainage and contact Architect for observation prior to placing pavement base or subbase courses. Refer to Section 31 2300 for additional compaction requirements. Once the subgrade has been proofrolled and approved it is the contractor's responsibility to protect including limiting traffic and construction activities. Any repairs and retesting required to obtain approved subgrade will be at the contractor's expense.

3.02 STABILIZATION FABRIC

A. Place paving stabilization fabric in lengths and widths as large as possible. Lap seams per manufacturer's instructions or 6 inch minimum.

B. Cover using methods that will not damage or displace stabilization fabric.

C. Time operations to avoid trenching by any contractor in areas where stabilization fabric has been placed.

3.03 COARSE AGGREGATE FILL

A. Place on dry subgrade on maximum 6 inch lifts. Compact each lift to standard noted under section 3.1 above.

B. Remove all subgrade material churned or mixed with subbase courses and replace as necessary at Contractor's expense.

3.04 SUBBASE COURSE

A. Place on dry subgrade or subbase course as detailed in maximum 6 inch lifts. Compact each lift to standard noted under section 3.1 above.

B. Remove all subgrade or subbase course material churned or mixed with base course and replace as necessary at Contractor's expense.

END OF SECTION 32 1100

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Place and compact asphalt base course, binder and topping.
2. Asphalt Pavement
3. Cold Milling

B. Related Sections:
1. Section 32 1100 - Base Courses.
2. Section 32 1217 – Asphalt Pavement Sealing

1.02 SUBMITTALS

A. Material Certificate (MC): Each asphaltic concrete course shall comply with an applicable NYSDOT Job Mix Formula showing NYSDOT signature approval for prior use in the region within the past two years. Submit for the following:
1. Asphalt Top Course - NYSDOT Type 7: (MC)
2. Asphalt Binder Course - NYSDOT Type 3: (MC)
3. Asphalt Base Course – NYSDOT Type 1: (MC)

PART 2 – PRODUCTS

2.01 MATERIALS

A. Asphalt pavement: Plant mix asphalt conforming to NYSDOT Standard Specifications Section 401, Material Requirements, 1990 edition. Paving course as shown on drawings:
1. Asphalt Top Course: Type 7 asphalt concrete conforming to composition requirements of Table 401-1. Installation temperature 280° - 325°F, compacted thickness - per detail and where noted on the plans.
2. Asphalt Binder Course: Type 3 asphalt concrete conforming to composition requirements of Table 401-1. Installation temperature 280° - 325°F, compacted thickness - per detail.
3. Asphalt Base Course: Type 1 asphalt concrete conforming to composition requirements of Table 401-1. Installation temperature 280° - 325°F, compacted thickness - per detail.

B. Above mixes shall contain only crushed limestone coarse aggregates.

C. Tack Coat: NYSDOT Asphalt Emulsion 702-90, prepared, heated, and uniformly sprayed at rate of 5 gallons per square yard in accordance with NYSDOT requirements.

D. Joint Sealer: NYSDOT Liquid Asphalt 702-11 or similar.

E. Comply with all requirements of NYSDOT Section 401.

2.02 COLD MILLING EQUIPMENT

A. The Contractor shall use cold milling equipment with automatic grade and slope controls, capable of cold milling existing asphalt pavement to an accurate depth of cut, profile and cross slope and shall be capable of loading the milled material directly into trucks.

PART 3 - EXECUTION

3.01 COLD MILLING OPERATIONS

A. Cold milling asphalt pavement shall be performed in a manner which prevents the tearing and breaking of underlying and adjacent pavement and the contamination of the Reclaimed Asphalt Pavement (RAP) with granular, subgrade or deleterious materials. All RAP shall be loaded directly to trucks from the milling machine and hauled to stockpile or disposed of.

B. The milled roadway surface shall be swept clean prior to opening to traffic. The Contractor shall sweep the surface in a manner which minimizes dust.

C. The Contractor shall, at his own expense, promptly repair any localized areas of distress in the milled surface that may present a hazard to traffic.

D. At the point of daily termination of cold milling operations, changes in roadway surface profile or crosssection shall be limited to 2-inches and longitudinal transitions shall be a maximum of 1-inch mm vertically per yard.

E. In the event of rain or other inclement weather, the Contractor shall suspend cold milling operations. The Contractor shall make necessary allowances for drainage of water that may pond in areas where the milled sections have not been paved.

F. When milling smaller areas or areas where it is impractical to use the above described equipment, the use of a smaller or lesser equipped milling machine may be permitted when approved by the Architect.

G. Protection shall be provided around existing catch basin inlets, manholes, utility valve boxes, and any similar structures. Any damage to such structures as a result of the milling operation is the Contractor's responsibility and shall be repaired at the Contractor's expense.

H. To prevent the infiltration of milled material into the storm sewer system, the Contractor shall take special care to prevent the milled material from falling into the inlet openings or inlet grates. Any milled material that has fallen into inlet openings or inlet grates shall be removed at the Contractor's expense.

I. At all permanent limits of milling, a clean vertical face shall be established prior to paving. No vertical faces, transverse or longitudinal, shall be left exposed to traffic. If any vertical face is formed in an area exposed to traffic a temporary paved transition shall be established. If a vertical face is not formed and the milling machine is used to temporarily transition the milled pavement surface to the existing pavement surface.

3.02 ASPHALT PAVEMENT

A. Place and roll each course with approved 10-ton roller until no movement or weaving occur. Correct all humps and depressions to provide smooth surface at correct profile and grade.

B. Install no asphaltic work when surface is wet or temperature below 50°F.

C. Form or cut all pavement edges to clean, sharp, lines of dimensions, alignment, or radius indicated.

D. Joints: Saw cut and shear step joints along existing paving to remain. All joints between new and existing paving or in new paving where work has been discontinued overnight shall be cap sealed.

E. Compaction: Thoroughly and uniformly compact each asphalt course with powered rollers of not less than 10 tons with working watering systems, and with power tampers in and along areas not accessible to the roller. Rollers should move at uniform speeds and not cause undue displacement, cracking or shoving or other movement. Exercise care not to displace the line and grade of edges or any joints. Joints shall be tightly bonded and match surface smoothness and compaction of other sections of the pavement.

F. Surface Tolerance: Base and binder course surface shall be a true plane consistent with required top course surface grades.

Top course surface shall not vary more than 1/8" in 10' measured in any direction, and shall be a true plane consistent with required surface grades. Paving crown lines shall be true with roadway center lines. Finished top course surface shall be flood checked by the Contractor when requested by the Architect in any areas where ponding or inadequate drainage appears evident.

Portions of completed pavement which are defective in finish, compaction, elevation or drainage shall be cut out, removed and replaced. No waviness or irregularities; no ridges; no open or inadequately bonded seams; no abrupt grade changes at catch basins or other structures, center line or other, or elsewhere.

3.03 ASPHALT OVERLAY

A. General: Thoroughly clean surfaces to be in contact with new asphalt concrete overlay.
1. Clean flat surfaces with rotary power brooms, or high velocity compressed air methods.
2. Wash or flush as necessary to remove clay or dirt.
3. Rough, high spots or over-asphalted areas shall be brought to grade by burning or blading.

B. True and Level: Repair areas of severe cracking or subgrade failure to full depth of asphalt, prior to asphalt overlay.
1. Extend asphalt removal minimum 12 inches (304.8 mm) into satisfactory pavement surrounding area to be patched.
2. Repairs should be square-edged and cuts rectangular in shape.

3. Apply tack coat to vertical faces of pavement.
4. Comply with compaction and surface tolerance requirements specified for asphalt concrete pavement.

3.04 PAVEMENT GUARANTEE

A. Two-Year Guarantee against Defects in Paving: Contractor guarantees that any areas of settlement, heaving or other movement, cracks, spalling, raveling, surface pitting, flaking or other deterioration, or any other defects which occur in any new or replacement paving, as determined by the Architect and Owner, occurring within two (2) years after the date of substantial Completion, shall be cut out, removed, replaced and corrected to the satisfaction of the Architect and Owner, at the contractor's expense, in accordance with provisions of the contract dealing with correction of work.

END OF SECTION 32 1216

PART 1 - GENERAL

1.01 SUMMARY

A. Work Includes:
1. Concrete Walk Pavement.
2. Reinforcing – Epoxy Coated
3. Joints.
4. Finishing.

B. Related sections:
1. Section 32 1100 - Base Courses

1.02 SUBMITTALS

A. Submit Manufacturers Data and concrete mix designs for the following:
1. 3500/4000 psi concrete mix design
2. Expansion Joint (MD)
3. Anti Spalling Compound (MD)
4. Sealant (MD)
5. Reinforcement (MD)

PART 2 - PRODUCTS

2.01 MATERIALS

A. Concrete: ready-mix air entrained normal weight concrete mixed in accordance with ACI 304; all concrete pavement shall be reinforced and installed in one (1) course; provide the following concrete mix designs:

	Subsurface Concrete, etc.	Paving Course
Compressive Strength (28 Days)	3500 psi	4000 psi
Water/Cement ratio (max.)	0.42 by weight	0.42 by weight
Aggregate Size (Max.)	#1 & #2 (60%/40%)	#1 & #2 (60%/40%)
Air Entrainment	4.5%-7.5%	4.5%-7.5%
Slump	4" +/- 1"	4" max.
Min. Bags Cement per CY	6.5	6.5

Comply with the following:
1. Portland cement: ASTM C150, Type 1.
2. Normal weight aggregates: ASTM C33 and as specified.
3. Fine aggregate: Clean, sharp, natural, sand, free from loam, clay and other deleterious substances.
4. Coarse aggregate: Crushed stone (no gravel) processed from hard, natural rock or stone, clean, uncoated, containing no soil or other foreign matter.
5. Water: Potable, clean water.
6. Air entraining admixture: ASTM C260 certified by manufacturer to be compatible with other required admixtures. Use in strict compliance with manufacturers recommendations. Sealtight AEA, W R Meadows, Inc. or approved equal.
7. Ready-mix concrete, comply with ASTM C94. Additional water not permitted to batch for material with insufficient slump. During hot weather or under other conditions contributing to rapid setting of concrete, shorter mixing time than specified in ASTM C94 may be required. When air temperature is between 85°F and 90°F, reduce mixing/delivery time from 90 minutes to 75 minutes. Cold weather curing protection per ACI recommendations. Provide concrete design mix reports/certificates from supplier, including verification that identical mixes have previously tested at required minimum compressive strength at 28 days. Once approved, all concrete shall be identically mixed by the same supplier; no variations in materials, mix, color permitted.

B. Expansion joint material: ½" thick premolded asphalt impregnated joint filler: compatible gun grade one or two component sealer, gray color with removable cap.

C. Moisture-Retaining Cover: Sheet material for curing concrete: ASTM C171. Provide one of the following:
1. Waterproof paper.
2. Polyethylene film (min. 6mil. thickness)
3. Polyethylene-coated burlap.

D. Anti-Spalling Compound: Anti-spalling compound shall be a clear penetrating solution which will not discolor or alter the appearance of the concrete. Available products subject to compliance with requirements. Manufacturers products to include but are not limited to the following:
   1. SureCure Emulsion, Kaufman Products, Inc. 3811 Curtis Avenue, Baltimore, MD 21226, (800) 637-6372.
   2. Cure & Seal by Symons Corp., 200 East Touhy Ave., PO Box 5018, Des Plaines, IL 60017-5018, (708) 298-3200.
   3. Kure-N-Seal 0800 by Sonneborn Building Products, Chemrex, Inc., 889 Valley Park Dr., Shakopee, MN 55379, (800) 433-9517.

E. Welded wire mesh/fabric: 6" x 6" welded 6 gauge steel wire fabric ASTM A185, in flat sheets.

F. Synthetic Micro-Fiber Reinforcement: Monofilament polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116 / C 1116M, Type III, 1/2 to 1-1/2 inches long.

G. Reinforcing steel: ASTM A615 deformed per ASTM A305, grade 40 for bar sizes #4 and smaller; grade 60 for larger bar sizes. All new reinforcing steel to be epoxy coated.

H. Sleeves and other inserts: As may be shown on drawings.

I. Subsurface Concrete: to be used for Footings, Beddings, Encasements, Cradles, or supports.

PART 3 - EXECUTION

3.01 EXECUTION

A. Preparation for concrete walk and curbs:
   1. Grade smooth draining grades parallel to finish grade and to proper subgrade elevations. No humps or hollows. Roll with approved 10-ton roller until no movement occurs. Do above operations concurrently. Subgrade shall be smooth, hard and dry.
   2. Do not deliver concrete until immediately prior to intended time of installation.
   3. Comply fully with the Latest American Concrete Institute Manual of Concrete Practice in mixing, delivery, forming, installation, curing and other aspects of concrete work.

B. Concrete Walk Pavement:
   1. Location and Layout: All lines, limits and elevations of paving, curbs and related work accurately located and laid out and staked or otherwise marked and checked and verified prior to installation.
   2. Subgrade and base course: check previously established subgrade for any disturbance. Install and compact base course aggregate. Refer to Section 31 2300 Excavation, Backfilling and Compacting.
   3. Forms: All forms fabricated of wood or steel to full required depth and to facilitate placing of reinforcing bars or mesh as required to support weight of concrete during and after pouring, and to produce neat, true corners and straight and radius edges as required.
   4. Placing of concrete: Concrete not placed until reinforcement, expansion joint filler and any sleeves and other inserts are placed and secured and forms are cleaned and oiled. When conditions of excessive drying occur, wet aggregate base course immediately prior to installation of concrete. Place concrete in forms, vibrating to work concrete into all corners and to eliminate honeycombing. Exercise care against displacement of forms. If free water appears on top of concrete, reduce quantity of water, take up immediately with cloth or mop, no application of sand or concrete permitted.
   5. Joints: provide expansion joints wherever paving adjoins building walls or other structures or rigid paving, off building corners, at changes in direction, at approximately 30' o.c. in runs of walk paving, and as otherwise shown on the drawings.
   6. Concrete finishing: surface of concrete brought to a smooth level finish, free of any swirls or float marks by means of an appropriate float. Provide steel trowel finish on top and face of integral curb and where otherwise required. Provide tooled edge “picture frame” bands with stiff broom finish where indicated. Finish concrete pavement edges tooled round same as joints. Score joints and bands tooled before and again after brooming while concrete is still green.
   7. Expansion joints: neatly cut out expansion joint material to ½" depth below surface and install consistent 1/4” depth of sealer system in accordance with manufacturers recommendations.
   8. Protection and curing: Immediately after finishing, surfaces to be protected with waterproof paper covering from traffic and elements for at least three (3) days before opening to traffic. Take necessary precautions to prevent plastic shrinkage cracks during curing. Apply sealant in accordance with manufacturer's recommendations. Protect all concrete work from vandalism. Concrete work which has been vandalized shall be removed and replaced at contractor’s expense.
   9. Backfill: all concrete work backfilled in accordance with adjoining work requirements. Backfilling shall proceed immediately after removal of the forms and shall be conducted with care assuring that concrete damage and settlement do not occur. Do not mar surfaces with backfill material or equipment.

3.02 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. The owner shall employ a testing laboratory to take samples and perform tests and to submit test reports. The contractor shall notify the testing agency and the owner's representative for testing in a timely manner.

B. Quality Control testing in field shall be performed by ACI certified Grade I Field Technician. Concrete shall not be placed without a technician onsite.

C. Sampling and testing for quality control during placement of concrete may include the following:
   1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
   2. Slump: ASTM C 143; one test at point of discharge for each day's placement of each type of concrete and each time a set of compression test specimens are made; additional tests when concrete consistency seems to have changed.
   3. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure method for normal weight concrete; one for each day's placement of each type of concrete and each time a set of compression test specimens are made.
   4. Concrete Temperature: Test hourly when air temperature is 40 degrees F. and below and when 80 degrees and above; and each time a sample is taken.
   5. Compression Test Specimens: ASTM C 31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.
   6. Compressive Strength Tests: ASTM C 39; one set for each day's placement under 25 cubic yards plus additional sets for each 50 cubic yards over and above the first 25 cubic yards of each concrete placed in any one day. One specimen tested at 7 days, two specimens tested at 28 days, and one specimen reserved for later testing if required.
   7. When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
   8. When total quantity of a given class of concrete is less than 50 cubic yards strength test may be waived by Architect if, in his judgment, adequate evidence of satisfactory strength is provided.
   9. Strength level of concrete will be considered satisfactory if averages of set of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test results falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, Owner, Landscape Architect, Contractor and concrete supplier within 24 hours after tests if it fails to meet minimum compressive strength, otherwise within 5 days. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength and type of break for both 7-day and 28-day tests.

E. Nondestructive testing: impact hammer, sonoscope or other non-destructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

F. Additional test: the testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. The sitework Contractor shall pay for such tests when unacceptable concrete is verified.

3.03 PAVEMENT GUARANTEE

A. Two-Year Guarantee against Defects in Paving: Contractor guarantees that any areas of settlement, heaving or other movement, cracks, spalling, raveling, surface pitting, flaking or other deterioration, or any other defects which occur in any new or replacement paving, as determined by the Architect and Owner, occurring within two (2) years after the date of substantial Completion, shall be cut out, removed, replaced and corrected to the satisfaction of the Architect and Owner, at the contractor's expense, in accordance with provisions of the contract dealing with correction of work.

END OF SECTION 32 1313

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:
   1. Pavement line paint.
   2. Pavement markings and symbols

B. Related sections:
   1. Section 32 1216

1.02 REFERENCES

A. NYSDOT standard specifications.

1.03 SUBMITTALS

A. Submit manufacturers' data (MD) and color samples (S) for the following:
   1. Paint Manufacturer (MD)
   2. Color sample (S), one per color.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Pavement lines paint:
   1. Lead-free yellow, blue, red, green or white marking paint complying with NYSDOT Section 640-2, selected from NYSDOT "Approved List." Refer to drawings and details for locations of each color.

PART 3 – EXECUTION

3.01 PAVEMENT LINES PAINTING

A. Allow pavement/pavement sealer to properly cure to manufacturers recommendations prior to striping. Apply one coat by brush or zone marking equipment to the location, limits, and colors indicated on the drawings.

B. Comply with NYSDOT wet thickness requirements.

END OF SECTION 32 1723

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
   1. Seeding Lawns.
   2. Hydro-seeding Lawns.

B. Related Sections:
   1. Section 31 2216: Fine Grading.
   2. Section 31 2500: Erosion, Sediment and Pollution Control.

1.02 SUBMITTALS

A. Provide Material Certificates (MC) and Manufacturers Data (MD) for the following:
   1. Seed each mix species and source
   2. Fertilizers
   3. Jute Mesh
   4. Tackifier
   5. Mulch

B. Furnish name of Landscape Contractor or Nurseryman to perform lawn work and obtain Architect's approval.

C. Lawn Seed Mix: Submit one (1 lb.) pound seed mix sample per seed mixture specified in vendor's sealed package. Label shall clearly show weight, analysis by weight of each species, percent purity, percent germination, and vendor name.

D. Slope Seed Mix: Submit one (1 lb.) pound seed mix sample per seed mixture specified in vendor's sealed package. Label shall clearly show weight, analysis by weight of each species, percent purity, percent germination, and vendor name.

E. Upon seeded lawn acceptance, submit written instructions recommending procedures for maintenance of each lawn type area.

1.03 DELIVERY AND STORAGE

A. Deliver seed and fertilizer materials in original unopened containers, showing weight, analysis, and name of manufacturer. Store in a manner to prevent wetting and deterioration.

1.04 PROJECT CONDITIONS

A. Work notification: Notify Owner at least 7 working days prior to start of seeding operations.

B. Protect existing utilities, paving, and other facilities from damage caused by seeding operations.

C. Perform seeding work only after planting and other work affecting ground surface has been completed.

D. Restrict traffic from lawn areas until grass is established. Erect signs and barriers as required.

E. Provide hose and lawn watering equipment as required.

1.05 WARRANTY

A. Provide a uniform stand of grass by watering, mowing, and maintaining seeded areas until final acceptance. Reseed areas, with specified materials, which fail to provide a uniform stand of grass, until all affected areas are accepted by the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Lawn fertilizer: Commercial, 32-0-6 ratio of Nitrogen, Phosphorus, and Potash

B. Lawn seed: Fresh, clean, new crop. Deliver in original packages, unopened, bearing guaranteed analysis.

1. Seeded Lawn Mixture: Mixture containing improved varieties of perennial ryegrass, fescue, and bluegrass. Northern Landscape Utility Mix as distributed by Northern Nurseries, Cicero, NY (315-699-3999), or approved equal.

COMMON NAMES	PROPORTION BY WEIGHT	PERCENT PURITY	GERMINATION
Perennial Ryegrass	50	92	80
Chewing Fescue	15	85	80
Creeping Red Fescue	15	97	80
Baron Kentucky Bluegrass	20	92	80

C. Soil stabilizer: Manufactured by Soil Seal Corp., Riverside, CA or approved equal.

D. Mulch:
1. Straw Mulch for Lawns: Stalks of oats, wheat, rye, or other approved crops free from seed or noxious weeds.
2. Cellulose Fiber Mulch for Lawns: Terra-Mulch Cellulose Fiber by PROFILE Products LLC, or approved equal, distributed by Northern Nurseries, Cicero, NY (315-699-3999). Mulch shall comply with the following characteristics.
   a. Materials: Cellulose fiber, dark green dye.
   b. pH Range: 7.0 plus or minus 2.
   c. Moisture Content: 12 plus or minus 3 percent maximum.
   d. Organic Content: 93.0 percent plus or minus 3 percent.
   e. Ash Content: 7.0 percent plus or minus 3 percent.
   f. Water Holding Capacity: 1080 percent minimum.
   g. Fiber Mulch Slurry Viscosity: 1.55 cps plus or minus .10 (Test Method: Falling Ball Viscometer) Test condition 1500 lb. of fiber mulch per 3000 gallons of water, evaluated immediately after mixing.
   h. Packaging: 50 pound UV resistant bags, with UV resistant pallet cover.

E. Jute Mesh;
1. Lightweight nonwoven erosion control/revegetation blanket comprised primarily of virgin wood fiber.
2. Wire Staples: Twelve inch lengths of No. 11 gauge wire bent to form a “U”, or other wire staples as approved by the architect.

F. Water for Sod/Lawn Irrigation;
1. Contractor shall install irrigation system to working condition prior to installation of sod and lawn. Contractor shall use irrigation system for all sod and lawn watering requirements.

PART 3 - EXECUTION

3.01 LAWNS/GENERAL

A. Where applicable, check and verify fine grading of respread screened stockpiled topsoil and off-site topsoil; repair any disturbances.

B. Where applicable, complete discing, raking, regrading, reconditioning and compost amendment of surface soils.

3.02 SEEDED LAWN

A. Scope: Make entire unpaved areas within contract limits new lawn unless otherwise noted. Refer to drawings for location of Seeded Lawn Mixture and Athletic Field Seed Mixture areas. Use Seeded Lawn Mixture in all other areas of disturbance beyond contract limits.

B. Season of year for seeding, hydroseeding, and sodding subject to approval by Architect. Do not seed or sod or hydroseed when high wind, drought, excessive moisture, ice, or other conditions are such that specified results are not likely to be obtained.

C. Fertilize: Evenly distribute at manufacturers recommendation. Work lightly into top 3" of soil.

D. Seed:
1. Rake immediately before seeding until surface is smooth, friable and of uniform fine texture. Roll. Rake out undulations shown by roller.
2. Uniformly spread seed in at least two directions at rate of 5 pounds per 1,000 square feet with approved mechanical spreader. Cover seed distributed on the surface to a depth not exceeding 1/4" by raking, brush, or chain harrowing, or other approved methods. Roll with 200 pound roller.

E. Straw Mulch all seeded areas immediately after seeding unless hydroseeding. Hand or machine spread to form a continuous blanket 2" uniform thickness, loose measurement. Anchorage to hold mulch in place may be employed at contractor's option, subject to approval by Architect.

F. Hydroseeding:
   1. All hydroseeding shall be applied by means of a hydroseed machine.
   2. Mixture - Mix water, seed, fertilizer, mulch and soil stabilizer at the following rates and apply to the prepared finish grade by means of a hand-held hose. No truck mounted spraying equipment shall be driven over the areas to be seeded. Discharge shall be in an uphill direction only.
      a. Fertilizer 1,000 lbs. per acre
      b. Seed 250 lbs. per acre
      c. Mulch 1,500 lbs. per acre
      d. Soil Stabilizer 25 gal. per acre
   3. Strictly comply with manufacturer's installation instructions and recommendations. Use approved hydro-spraying machines. Do not exceed maximum slope length of 25 feet. Install materials at the following application rate:
      a. Hydro-Seeding: Add 35 to 50 pounds of Terra-Mulch Cellulose Fiber per 100 gallons of water when hydroseeding; confirm loading rates with equipment manufacturer.
         i. Mod to 4 : 1 Slope: 1500 pounds per acre.
         ii. 4 : 1 Slope: 2000 pounds per acre.
      b. Hay and Straw Seeding: Mulch binding, 750 pounds per acre.

G. Protect all seeded and hydroseeded areas, at contractor's expense, with snow fences, wire farm fences, or similar structures. Remove upon final acceptance. On steep slopes or areas subject to erosion, stabilize topsoil and seed as required to allow adequate germination.

H. Maintain lawn:
   1. Begin immediately upon completion of seeding and mulching and continue for a minimum of 30 days or longer as required to establish uniform stand of specified grasses and until final acceptance.
   2. Water immediately after mulching to saturate the soil to 1/2" depth. Thereafter, water all seeded areas to 1" depth soil saturation no less than two times per week, and more often during periods of drought or high winds, as required by Architect until final acceptance.
   3. Maintain mulch daily, or more often as required. Contain mulch on site and clean up any areas where mulch is blown by wind.
   4. Repair all washouts and gullies. Rerake, reseed and remulch as necessary.
   5. Mow all lawn areas to 2" height until acceptance. Grass shall not exceed 3" in height. A minimum of three mowings is required.

I. Inspection and final acceptance of lawns:
   1. Contractor shall request inspection by Architect after establishment of uniformly germinated lawn and completion of maintenance.
   2. Owner's responsibility after final acceptance.

3.03 JUTE MESH

A. Installation of fabric requires 12" minimum overlap at all seams/joints in all directions, upstream sheets to overlap downstream sheets, except where manufacturer's recommendations may vary.

END SECTION 32 9200

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
   1. Trench Drain

B. Related Work Specified Elsewhere.
   1. Section 31 1001 – Site Preparation
   2. Section 31 2300 – Excavation, Backfilling and Compacting:
   3. Section 32 1216 – Asphalt Pavement

1.02 SUBMITTALS

A. Submit Shop Drawings (SD) and Manufacturers' Product Data (MD) for the items listed below and any special construction details relating to the storm drainage system.
   1. Trench Drain: one (SD) per structure.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Concrete: As specified Section 32 1313 "Site Concrete". Minimum compressive strength 3,000 psi at 28 days.

B. Reinforcing: As specified Section 32 1313 "Site Concrete".

C. Mortar: Cement-lime-sand, 1:1:3 mix.

D. Trench Drains: The surface drainage system shall be ACO Cross Sidewalk Drain system H100KS-8 complete with downspout inlet, curb outlet, ADA compliant grate and 4" QuickLock locking bar system as manufactured by ACO (www.acodrains.us) or approved equal.
   1. The trench drain system bodies shall be manufactured from polyester polymer concrete with minimum properties as follows:
      a. Compressive Strength: 14,000 psi
      b. Flexural Strength: 4,000 psi
      c. Water Absorption: .07%
      d. Frost Proof
      e. Salt Proof
      f. Dilute acid and alkali resistant
   2. Downspout Inlet: ACO part number 96932
   3. H100KS-8 4" internal width ACO Constant Depth (2.56") Drain
   4. Curb Outlet: ACO Part Number 96924
   5. Grate: ADA Compliant
   6. Locking System: 4" QuickLock Locking Bar System

PART 3 - EXECUTION

3.01 TRENCH DRAIN SYSTEM

A. The trench drain system shall be installed in accordance with the manufacturer's installation instructions and recommendations.

END OF SECTION 33 4000