NEW YORK STATE OF OPPORTUNITY.

Roosevelt Island Operating Corporation

Request for Proposal
16-32080
Technical Specification
Construction of 2 Elevators for the Manhattan Tram Station Project

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SECTION 011000 - SUMMARY

1.1 PROJECT INFORMATION

A. Project Identification: Design of Two New Elevators for Manhattan Tram Station.

1. Project Location: **254 East 60th Street, New York, NY 10022**

2. Block and Lot: **Manhattan Block 1414, Lot 9999, Historic Lot 28**

B. Owner: **Roosevelt Island Operating Corporation of the State of New York**.

1. Owner's Representative: Susan Rosenthal, CEO/VP. General Counsel

C. Architect/Engineer: **GC Eng & Associates, PC**.

D. The Engineer has retained the following design professionals who have prepared designated portions of the Contract Documents:

1. Structural: **Architectural & Engineering Group, P.C**.

E. Project Web Site: A project Web site administered by **GC Eng & Associates, PC** will be used for purposes of managing communication and documents during the construction stage.

1. Using the Project Web site: TBD

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

B. As part of the modernization of the Aerial Tramway, RIOC seeks to install required ADA compliant elevators to accommodate the transportation needs of the many island and Manhattan residents as well as the tourists with disabilities who utilize this mode of transportation. The proposed site for the installation is on the grounds of the Manhattan Tram Station at 60th Street and 2nd Avenue in Tramway Plaza.

C. Installation of (2) 2,500 lbs. capacity traction elevators in glass enclosed steel structure on concrete foundation. The new elevator shaft will be located south side of the existing elevator and a chairlift attached to the existing Tram station platform, and will be connected with a bridge to the platform of the building. The new bridge will be covered with a glass canopy and wind shield. The existing elevator will remain operational while the new elevators are constructed. The

construction will be phased to have one of the elevators operational when the existing elevator is demolished.

D. The machine room is located on the top level of the elevator shaft, and will be air conditioned with split air system. The machine room floor at the top of the shaft will have (2) 22”x22” openings with gratings. For required vent and overheating the shaft, Dual Exhaust Fans on the roof will vent elevator shaft alternately preventing the one failure or the other. The west wall of the machine room will have solid interior cladding for electrical panels and switches. Exterior side of cladding works as a duct space as well.

E. The 5-0” elevator pit will have 2’-0’ deep sump pit with pump. Roof of elevator with primary scupper drain and secondary scupper drain provided. Funnel drain provided for HVAC condensation drain. Gutter drain provided for glass canopy. All drains mentioned to be discharged to 3” leader and connected to existing underground storm. Area drains on 2nd floor platform and on the ground floor to be connected to existing station drain system.

Elevator cabs to have LED lighting top and bottom as well as interior lighting. Canopy and wind shield on platform level to have continuous LED light strips. The ground level waiting area will have LED down lights throughout. The new elevators will alternately be connected to emergency generator. Snow Melting Cable embedded at Elevator entries on both level.

F. Scope of Work listed below, but not limited to:

Arch/General

1. (2) 2,500 lbs. capacity traction elevators with glass enclosed cabs.

2. Structural glass enclosure on steel structure on concrete foundation.

3. Connection Bridge to the platform of the building on steel structure, metal deck and concrete.

4. Structural glass canopy and wind shield on platform level.

5. Glass handrail on Platform Bridge.

6. Wrought iron fence and gate at machine room access.

7. Steel fence under existing stair landing.

8. Metal panels on parapet walls and a machine room wall inside structural glass facing exterior.

9. Metal panel ceiling on platform bridge on ground level and top of shaft.

10. Steel ships ladder and landings, and a stainless steel door and frame to access machine room.

11. Stainless steel lover, frame and signage at elevator door.

12. Roll up security gate in elevator header on ground level.

13. Membrane roofing on tapered insulation on concrete deck and equipment rails with flashing.

14. Roof access hatch and a ladder on roof.

15. Remove existing pavers, planter fence and trees, rearrange planter, reinstall pavers and fence as indicated.

16. Concrete equipment pad and prefabricated metal shed for electrical panels in north planting area.

17. The existing elevator to remain operational while the new elevators are constructed. The construction will be phased to have one of the elevators operational when the existing elevator is demolished.

HVAC

1. (2) Split-air air condition system in machine room located on top of the elevator shaft.
2. (2) Exhaust fan s mounted on parapet wall for venting elevator shaft.

Plumbing

1. 2’-0’ deep sump pit with pump in elevator pit.

2. Primary scupper drain and secondary scupper drain on roof level and Gutter drain provided for glass canopy, discharged to 3” leader and connected to existing underground storm.

3. Funnel drain for HVAC condensation in machine room.

4. Area drain on 2nd floor platform and an area drain for the ground floor to be connected to existing 6” storm drain.

Fire Alarm

1. Fire alarm devices in new elevator shaft. Install in rigid steel conduit. Connect to existing F.A. system.

2. Run exterior trench, from new elevator to existing station structure.

Electrical

1. 300 amp circuit breaker, to accommodate additional elevator loads.

2. Automatic transfer switch and emergency panel, to feed the new elevators. Note only one to run at a time, due to existing generator capacity.

3. Power and controls to new elevator, via new exterior trench.

4. Snow melting system for the two (2) new landings.

5. Lighting circuits, and lighting controls.

6. Demolition of existing elevator and lift, after installation of new.

7. Circuits for new rollup gate.

8. Power for new AC units for elevator machine room.

PART 2 - PHASING

2.01 PHASING OF THE WORK

A. Project will be constructed in separate Phasing as identified or as described in this Section or Contract Documents. Phasing will also delineate Work to be completed in each designated phase. Unless otherwise approved or directed by Owner, each phase shall be completed according to approved Baseline Schedule prior to commencement of next subsequent phase. The Contractor shall incorporate and coordinate Work of Separate Work Contracts relative to this Project into the Phasing and Construction Schedule.

B. The Contractor shall install all necessary Work for, but not limited to, power, lighting, signal, HVAC, drainage, and plumbing systems in phased Work before completion of designated phase. All valves, pull boxes, stub outs, temporary capping, and other Work necessary for phased completion and operation of all necessary systems shall be provided whether or not such Work is specifically identified in Contract Documents.

2.02 PHASING OF THE WORK – GENERAL

A. The Contractor shall prepare Construction Schedule in order to complete Work and related activities in accordance with phasing plan. The Contractor shall include all costs to complete all Work within Phasing or Contract Time.

B. Owner will be seriously damaged by not having all Work completed within Milestones or Contract Time. It is mandatory Work be complete within Milestones or Contract Time.

2.03 PHASING OF THE WORK – SPECIFIC

A. The Contractor shall prepare Construction Schedule, and shall complete the following within designated phases in accordance with following:

1. Phase 1 Construction

a. Construction of new elevators, elevator shaft, shaft enclosures, half of Platform Bridge and all related facilities while maintaining the existing elevator operational.

b. Contractor to install temporary scaffolding and/or stairs to make machine room accessible to operate and maintain new elevators.

2. Phase 2 Construction

a. Contractor to complete all required inspections and obtain permits to operate East Elevator before start of the Phase 2. East Elevator shall be operational in Phase 2.

b. Demolition of existing elevator, elevator shaft and all related equipment and items.

c. Construction of half of Platform Bridge, maintenance ladder, platform canopy and windshield, and all remaining items as shown on the contract documents.

d. Contractor to install scaffolding, enclosures, stairs, etc., to operate and maintain East Elevator, and to protect safety of the passengers in Phase 2.

3. Phase 3 Administrative Closeout

B. The Contract Time shall be a total of (**400**) calendar days from date of commencement of Contract Time.

END OF SECTION

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SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1 General coordination procedures.

2 Coordination drawings.

3 Requests for Information (RFIs).

4 Project Web site.

5 Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:

1 Section 013100 Project management and coordination

2 Section 013200 “Construction progress”.

3 Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

4 Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

5 Section 019113 "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

1.3 DEFINITIONS

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

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. **Use CSI Form 1.5A.** Include the following information in tabular form:

1 Name, address, and telephone number of entity performing subcontract or supplying products.

2 Number and title of related Specification Section(s) covered by subcontract.

3 Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within (15) fifteen days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1 Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

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

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

2 Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.

3 Make adequate provisions to accommodate items scheduled for later installation.

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

1 Preparation of Contractor's construction schedule.

2 Preparation of the schedule of values.

3 Installation and removal of temporary facilities and controls.

4 Delivery and processing of submittals.

5 Progress meetings.

6 Pre-installation conferences.

7 Project closeout activities.

8 Startup and adjustment of systems.

9 Salvage materials and equipment involved in performance incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 COORDINATION DRAWINGS – (Provide a separate cost)

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

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

a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.

d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
f. Indicate required installation sequences.
g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

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

1 Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.

2 Plenum Space: Indicate sub framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.

3 Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.

4 Structural Penetrations: Indicate penetrations and openings required for all disciplines.

5 Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.

6 Mechanical and Plumbing Work: Show the following:

a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.

7 Electrical Work: Show the following:

8 Runs of vertical and horizontal conduit.

a. Light fixture, exit light, , smoke detector, and other fire-alarm locations.

b. Panel board, switch board, switchgear, Automatic Transfer Switches, Crown Boxes, transformer, Pull/Splice Boxes, and motor control center locations, Temporary feeders and cables, etc.
c. Location of pull boxes and junction boxes dimensioned from column center lines.

9 Fire-Protection System: Show the following:

a. Locations of mains piping, branch lines, pipe drops, and sprinkler heads.

10 Review: Engineer will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Engineer determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1 File Preparation Format: Same digital data software program, version, and operating system as original Drawings.

2 File Preparation Format: REVIT DWG Version Auto Cadd, operating system.

3 File Submittal Format: Submit or post coordination drawing files using format same as file preparation format Portable Data File (PDF) format.

4 If requested by contractor, Engineer will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.

a. Engineer makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
b. Digital Data Software Program: Drawings are available in, 2-D Auto- Cadd. The Engineer has scanned 3-D and REVIT version of digital data software program and operating system. And the contractor may seek the Engineers assistance with coordinating and installation solutions.
c. Contractor shall execute a data licensing agreement in the form of AIA Document C106 Agreement sample included in this Project Manual Agreement form acceptable to Owner and Engineer.

1.7 REQUESTS FOR INFORMATION (RFIs)

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

1 Engineer will return RFIs submitted to Engineer by other entities controlled by Contractor with no response.

2 Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

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

1 Project name.

2 Project number.

3 Date.

4 Name of Contractor.

5 Name of Engineer

6 RFI number, numbered sequentially.

7 RFI subject.

8 Specification Section number and title and related paragraphs, as appropriate.

9 Drawing number and detail references, as appropriate.

10 Field dimensions and conditions, as appropriate.

11 Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.

12 Contractor's signature.

13 Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

C. RFI Forms: AIA Document G716 or acceptable to Engineer.

1 Attachments shall be electronic files in Adobe Acrobat PDF format.

D. Engineer's Action: Engineer will review each RFI, determine action required, and respond. Allow seven (7) working days for Engineer's response for each RFI. RFIs received by Engineer] after 1:00 p.m. will be considered as received the following working day.

1 The following Contractor-generated RFIs will be returned without action:

a. Requests for approval of submittals.
b. Requests for approval of substitutions.
c. Requests for approval of Contractor's means and methods.
d. Requests for coordination information already indicated in the Contract Documents.
e. Requests for adjustments in the Contract Time or the Contract Sum.
f. Requests for interpretation of Architect's actions on submittals.
g. Incomplete RFIs or inaccurately prepared RFIs.

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

3 Engineer's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Engineer in writing within [**10**] **ten** days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly Use CSI Log Form 13.2B. Include the following: Software log with not less than the following:

1 Project name.

2 Name and address of Contractor.

3 Name and address of Engineer

4 RFI number including RFIs that were returned without action or withdrawn.

5 RFI description.

6 Date the RFI was submitted.

7 Date Engineer response was received.

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

1 Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.8 PROJECT WEB SITE

A. Project Web site for purposes of hosting and managing project communication and documentation until Final Completion. Project Web site shall include the following functions:

1 Project directory.

2 Project correspondence.

3 Meeting minutes.

4 Contract modifications forms and logs.

5 RFI forms and logs.

6 Task and issue management.

7 Photo documentation.

8 Schedule and calendar management.

9 Submittals forms and logs.

10 Payment application forms.

11 Drawing and specification document hosting, viewing, and updating.

12 Online document collaboration.

13 Reminder and tracking functions.

14 Archiving functions.

B. Provide up to seven (7) Project Web site user licenses for use of the Owner Engineer.. Provide eight (8) hours of software training at Engineer's office for Project Web site users.

C. On completion of Project, provide **one** (**1)** complete archive copy of Project Web site files to Owner and to Engineer in a digital storage format acceptable to Architect.

1.9 PROJECT MEETINGS

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

1 Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Engineer of scheduled meeting dates and times.

2 Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

3 Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner**,** and Engineer, within **three (3)** days of the meeting.

B. Preconstruction Conference: **Engineer and owner will schedule and conduct** a preconstruction conference before starting construction, at a time convenient to Owner and Engineer, but no later than (**15**) **fifteen** days after execution of the Agreement.

1 Conduct the conference to review responsibilities and personnel assignments.

2 Attendees: Authorized representatives of Owner Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

3 Agenda: Discuss items of significance that could affect progress, including the following:

a. Tentative construction schedule.
b. Phasing.
c. Critical work sequencing and long-lead items.
d. Designation of key personnel and their duties.
e. Lines of communications.
f. Procedures for processing field decisions and Change Orders.
g. Procedures for RFIs.
h. Procedures for testing and inspecting.
i. Procedures for processing Applications for Payment.
j. Distribution of the Contract Documents.
k. Submittal procedures.
l. Preparation of record documents.
m. Use of the premises and **existing building**.
n. Work restrictions.
o. Working hours.
p. Owner's occupancy requirements.
q. Responsibility for temporary facilities and controls.
r. Procedures for disruptions and shutdowns.
s. Construction waste management and recycling.
t. Parking availability.
u. Office, work, and storage areas.

v. Equipment deliveries and priorities.
w. First aid.
x. Security.
y. Progress cleaning.

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

C. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination.

1 Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Engineer of scheduled meeting dates.

2 Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Possible conflicts.
i. Compatibility requirements.
j. Time schedules.
k. Manufacturer's written instructions.
l. Warranty requirements.
m. Compatibility of materials.
n. Acceptability of substrates.
o. Temporary facilities and controls.
p. Space and access limitations.
q. Regulations of authorities having jurisdiction.
r. Testing and inspecting requirements.
s. Installation procedures.
t. Coordination with other work.
u. Required performance results.
v. Protection of adjacent work.
w. Protection of construction and personnel.

3 Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.

4 Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.

5 Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: **Schedule and conduct** a project closeout conference, at a time convenient to Owner and Engineer, but no later than (**90**) **ninety** days prior to the scheduled date of Substantial Completion.

1 Conduct the conference to review requirements and responsibilities related to Project closeout.

2 Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

3 Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

a. Preparation of record documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Submittal of written warranties.
d. Requirements for preparing operations and maintenance data.
e. Requirements for delivery of material samples, attic stock, and spare parts.
f. Requirements for demonstration and training.
g. Preparation of Contractor's punch list.
h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
i. Submittal procedures.
j. Coordination of separate contracts.
k. Owner's partial occupancy requirements.
l. Installation of Owner's furniture, fixtures, and equipment.
m. Responsibility for removing temporary facilities and controls.

4 Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: **Conduct** progress meetings at bi **weekly** intervals.

1 Coordinate dates of meetings with preparation of payment requests.

2 Attendees: In addition to representatives of Owner and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

3 Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

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

1) Review schedule for next period.

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1. Startup construction schedule.
2. Contractor's construction schedule.
3. Construction schedule updating reports.
4. Daily construction reports.
5. Material location reports.
6. Site condition reports.
7. Special reports.

B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submitting schedules and reports.
2. Section 014000 "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

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

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.

2. Predecessor Activity: An activity that precedes another activity in the network.

3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Engineer.

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

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

E. Event: The starting or ending point of an activity.

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

1. Float time belongs to Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.

2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.

3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

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

1. Working electronic copy of schedule file, where indicated.

2. PDF electronic file.

3. **Two (2)** Paper copies.

B. Startup construction schedule.

1. Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

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

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

E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

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

G. Daily Construction Reports: Submit at **monthly** intervals.

H. Material Location Reports: Submit at **monthly intervals**.

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

J. Special Reports: Submit at time of unusual event.

1.5 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Engineer's request.

B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.

2. Verify availability of qualified personnel needed to develop and update schedule.

3. Discuss constraints, including phasing, work stages, area separations, interim milestones.

4. Review schedule for work of Owner's separate contracts.

5. Review submittal requirements and procedures.

6. Review time required for review of submittals and resubmittals.

7. Review requirements for tests and inspections by independent testing and inspecting agencies.

8. Review time required for Project closeout and Owner startup procedures.

9. Review and finalize list of construction activities to be included in schedule.

10. Review procedures for updating schedule.

1.6 COORDINATION

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

1. Secure time commitments for performing critical elements of the Work from entities involved.

2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

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

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

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

1. Activity Duration: Define activities so no activity is longer than (**7**) **seven** days, unless specifically allowed by Engineer.

2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery as follows:

a. Switchgear and major electrical equipment.

b. The preparation new Emergency equipment room and room arrangement

c. Temporary Generator

d. Temporary Switchboards

e. Temporary cabling of active electrical loads

f. The installation and wiring of electrical distribution risers with related temporary local power arrangements

g. New walls in existing Service room

3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.

4. Startup and Testing Time: Include no fewer than **fifteen** (**15**) days for startup and testing.

5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Engineer's administrative procedures necessary for certification of Substantial Completion.

6. Punch List and Final Completion: Include not more than **thirty** (**30**) days for completion of punch list items and final completion.

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

1. Phasing: Arrange list of activities on schedule by phase.

2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.

3. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.

4. Work Restrictions: Show the effect of the following items on the schedule:

a. Coordination with existing ongoing Hospital operations.
b. Limitations of continued occupancies.
c. Uninterruptible services.
d. Use of premises restrictions.
e. Environmental control.

5. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

a. Subcontract awards.
b. Submittals.
c. Purchases.
d. Fabrication.
e. Sample testing.
f. Deliveries.
g. Installation.

h. Tests and inspections.
i. Adjusting.
j. Curing.
k. Startup and placement into final use and operation.

6. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

a. Temporary Power
b. Temporary Generator
c. Phased equipment replacement process
d. Completion of mechanical installation.
e. Completion of electrical installation.
f. Substantial Completion.

7. Other Constraints: This Hospital building will require multiple controlled power disruptions. The work must be closely scheduled with the owner.

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

1. Temporary electrical supply to the building ongoing operations..

2. Provide milestones not indicated elsewhere.

E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.

1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.

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

1. Unresolved issues.

2. Unanswered Requests for Information.

3. Rejected or unreturned submittals.

4. Notations on returned submittals.

5. Pending modifications affecting the Work and Contract Time.

G. Recovery Schedule: When periodic update indicates the Work is **fourteen (14**) or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required achieving compliance, and dating by which recovery will be accomplished.

H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

I. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within **seven (7)** days of date established for **commencement of the Work**.

J. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first (**90**0 **ninty** days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within **thirty** (**30**) days of date established for **commencement of the Work**.. Base schedule on the startup construction schedule and additional information received since the start of Project.

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

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

C. Startup Network Diagram: Submit diagram within **fourteen** (**14**) days of date established for **commencement of the Work**. Outline significant construction activities for the first **ninety** (**90**) days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

D. CPM Schedule: Prepare Contractor's construction schedule using a **cost- and resource-loaded,** time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than **sixty** (**60**) days after date established for **commencement of the Work**.

a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.

2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.

3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.

4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.

E. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

   a. Preparation and processing of submittals.
   b. Mobilization and demobilization.
   c. Purchase of materials.
   d. Delivery.
   e. Fabrication.
   f. Utility interruptions.
   g. Temporary installation.
   h. Permanent installations
   i. Work by Owner that may affect or be affected by Contractor's activities.
   j. Testing
   k. Punch list and final completion.
   l. Activities occurring following final completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.

3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.

4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

   a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

5. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain

Architect's approval prior to assigning costs to fabrication and delivery activities. Assign costs under main subcontracts for testing activities, operation and maintenance manuals, punch list activities, Project record documents, and demonstration and training (if applicable), in the amount of **five** (**5**) percent of the Contract Sum.

a. Each activity cost shall reflect an appropriate value subject to approval by Engineer.
b. Total cost assigned to activities shall equal the total Contract Sum.

F. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

G. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.

2. Description of activity.

3. Main events of activity.

4. Immediate preceding and succeeding activities.

5. Early and late start dates.

6. Early and late finish dates.

7. Activity duration in workdays.

8. Total float or slack time.

9. Average size of workforce.

10. Dollar value of activity (coordinated with the schedule of values).

H. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.

2. Changes in early and late start dates.

3. Changes in early and late finish dates.

4. Changes in activity durations in workdays.

5. Changes in the critical path.

6. Changes in total float or slack time.

7. Changes in the Contract Time.

I. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.

1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.

2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.

3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.

4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.

a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
b. Submit value summary printouts **one (1)** week before each regularly scheduled progress meeting.

2.3 REPORTS

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

1. List of subcontractors at Project site.

2. List of separate contractors at Project site.

3. Approximate count of personnel at Project site.

4. Equipment at Project site.

5. Material deliveries.

6. High and low temperatures and general weather conditions, including presence of rain or snow.

7. Accidents.

8. Meetings and significant decisions.

9. Unusual events (see special reports).

10. Stoppages, delays, shortages, and losses.

11. Meter readings and similar recordings.

12. Emergency procedures.

13. Orders and requests of authorities having jurisdiction.

14. Change Orders received and implemented.

15. Work Change Directives received and implemented.

16. Services connected and disconnected.

17. Equipment or system tests and startups.

18. Partial completions and occupancies.

19. Substantial Completions authorized.

B. Material Location Reports: At **weekly** intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.

2. Material stored prior to previous report and since removed from storage and installed.

3. Material stored following previous report and remaining in storage.

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

2.4 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within **one (1)** day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, and response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.

1. In-House Option: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.

2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.

B. Contractor's Construction Schedule Updating: At **monthly** intervals, update schedule to reflect actual construction progress and activities. Issue schedule **one (1) week** before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.

2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

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

1. Post copies in Project meeting rooms.

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

END OF SECTION 013200

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SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.

2. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.

3. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.

4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

5. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Engineer responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Engineer responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

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

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

1.4 ACTION SUBMITTALS

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

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.

2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

   a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

   a. Scheduled date for first submittal.
   b. Specification Section number and title.
   c. Submittal category: Action; informational.
   d. Name of subcontractor.
   e. Description of the Work covered.
   f. Scheduled date for Engineer final release or approval.
   g. Scheduled date of fabrication.
   h. Scheduled dates for purchasing.
   i. Scheduled dates for installation.
   j. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Engineer's Digital Data Files: Electronic digital data files of the Contract Drawings will **not** be provided by Architect for Contractor's use in preparing submittals.

1. Engineer will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawing

    a. Engineer makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
    b. Digital Drawing Software Program: The Contract Drawings are available in **AutoCAD 2013**.
    c. Contractor shall execute a data licensing agreement in the form of **AIA Document C106, Digital Data Licensing Agreement** or an **Agreement form acceptable to Owner and Engineer**.
    d. The following digital data files will by furnished for each appropriate discipline:

        1) Floor plans.
        2) Reflected ceiling plans.

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

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.

3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

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

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

1. Initial Review: Allow **five** (**5**) days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.

2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.

3. Resubmittal Review: Allow **five** (**5**) days for review of each resubmittal.

4. Sequential Review: Where sequential review of submittals by Engineer's consultants, Owner, or other parties is indicated, allow **fifteen** (15) days for initial review of each submittal.

D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.

2. Provide a space approximately **6 by 8 inches (150 by 200 mm)** on label or beside title block to record Contractor's review and approval markings and action taken by Engineer.

3. Include the following information for processing and recording action taken:

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

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

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

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

a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Engineer.

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

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

1) Project name.
2) Date.
3) Destination (To:).
4) Source (From:).
5) Name and address of Architect.
6) Name of Construction Manager.
7) Name of Contractor.
8) Name of firm or entity that prepared submittal.
9) Names of subcontractor, manufacturer, and supplier.
10) Category and type of submittal.
11) Submittal purpose and description.
12) Specification Section number and title.
13) Specification paragraph number or drawing designation and generic name for each of multiple items.
14) Drawing number and detail references, as appropriate.
15) Indication of full or partial submittal.
16) Transmittal number, **numbered consecutively**.
17) Submittal and transmittal distribution record.
18) Remarks.
19) Signature of transmitter.

E. Electronic Submittals (is preferred): Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.

2. Name file with submittal number or other unique identifier, including revision identifier.

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

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Engineer.

4. Transmittal Form for Electronic Submittals: Use **electronic form** acceptable to Owner**,** containing the following information:

   a. Project name.
   b. Date.
   c. Name and address of Architect.
   d. Name of Construction Manager.
   e. Name of Contractor.
   f. Name of firm or entity that prepared submittal.
   g. Names of subcontractor, manufacturer, and supplier.

h. Category and type of submittal.
i. Submittal purpose and description.
j. Specification Section number and title.
k. Specification paragraph number or drawing designation and generic name for each of multiple items.
l. Drawing number and detail references, as appropriate.
m. Location(s) where product is to be installed, as appropriate.
n. Related physical samples submitted directly.
o. Indication of full or partial submittal.
p. Transmittal **numbered consecutively**.
q. Submittal and transmittal distribution record.
r. Other necessary identification.
s. Remarks.

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

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

F. Options: Identify options requiring selection by Engineer.

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

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

1. Note date and content of previous submittal.

2. Note date and content of revision in label or title block and clearly indicate extent of revision.

3. Resubmit submittals until they are marked with approval notation from Engineer action stamp.

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

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

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Post electronic submittals as PDF electronic files directly to specifically established for Project.

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

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

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

3. Action Submittals: Submit **three (3)** paper copies of each submittal unless otherwise indicated. Engineer will return **two (2)** copies.

4. Informational Submittals: Submit **two (2)** paper copies of each submittal unless otherwise indicated. Engineer will not return copies.

5. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

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

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

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.

2. Mark each copy of each submittal to show which products and options are applicable.

3. Include the following information, as applicable:

   a. Manufacturer's catalog cuts.
   b. Manufacturer's product specifications.

c. Standard color charts.
d. Statement of compliance with specified referenced standards.
e. Testing by recognized testing agency.
f. Application of testing agency labels and seals.
g. Notation of coordination requirements.
h. Availability and delivery time information.

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

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

5. Submit Product Data in the following format:

a. PDF electronic file.
b. **Three (3)** Paper copies of Product Data unless otherwise indicated. Engineer will return copies.

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

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

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

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least **8-1/2 by 11 inches (215 by 280 mm), but no larger than 30 by 42 inches (750 by 1067 mm)**

3. Submit Shop Drawings in the following format:

a. PDF electronic file.
b. **Two (2)** opaque (bond) copies of each submittal. Engineer will return **one (1)** copy.
c. **Three (3)** opaque copies of each submittal. Engineer will retain **two (2)** copies; remainder will be returned.

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

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.

2. Manufacturer and product name, and model number if applicable.

3. Number and name of room or space.

4. Location within room or space.

5. Submit product schedule in the following format:

   a. PDF electronic file.

E. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."

F. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."

G. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."

H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

J. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."

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

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

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

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

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

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

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

1. Name of evaluation organization.

2. Date of evaluation.

3. Time period when report is in effect.

4. Product and manufacturers' names.

5. Description of product.

6. Test procedures and results.

7. Limitations of use.

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

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

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

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit **digitally signed PDF electronic file and three**

(3) paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

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

2. Prepare delegated-design drawings in the following format: **Same digital data software program, version, and operating system as the original Drawings**.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

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

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."

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

3.2 ENGINEER’S ACTION

A. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or revisions required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action**.**

END OF SECTION 013300

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SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.

2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.

3. Requirements for Contractor to provide quality-assurance and -control services required by Engineer or authorities having jurisdiction are not limited by provisions of this Section.

4. Specific test and inspection requirements are not specified in this Section.

C. Related Requirements:

1. Section 012100 "Allowances" for testing and inspecting allowances.

1.3 DEFINITIONS

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

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

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

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

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

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

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

H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

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

1.4 CONFLICTING REQUIREMENTS

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

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

1.5 ACTION SUBMITTALS

A. Shop Drawings: For conduit Pull boxes, Crown boxes installation, provide plans, sections, and elevations, indicating materials and size of mockup construction.

1. Indicate manufacturer and model number of individual components.

1.6 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

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

1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Engineer.

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

D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.

2. Entity responsible for performing tests and inspections.

3. Description of test and inspection.

4. Identification of applicable standards.

5. Identification of test and inspection methods.

6. Number of tests and inspections required.

7. Time schedule or time span for tests and inspections.

8. Requirements for obtaining samples.

9. Unique characteristics of each quality-control service.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within **ten** [**10**] days of **Notice to Proceed**, and not less than **five (5)** days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

1. Project quality-control manager **may also serve as Project superintendent**.

C. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.

2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."

D. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements.

E. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Engineer has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.8 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.

2. Project title and number.

3. Name, address, and telephone number of testing agency.

4. Dates and locations of samples and tests or inspections.

5. Names of individuals making tests and inspections.

6. Description of the Work and test and inspection method.

7. Identification of product and Specification Section.

8. Complete test or inspection data.

9. Test and inspection results and an interpretation of test results.

10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.

11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.

12. Name and signature of laboratory inspector.

13. Recommendations on retesting and respecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.

2. Statement on condition of substrates and their acceptability for installation of product.

3. Statement that products at Project site comply with requirements.

4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.

5. Results of operational and other tests and a statement of whether observed performance complies with requirements.

6. Statement whether conditions, products, and installation will affect warranty.

7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.

2. Statement that equipment complies with requirements.

3. Results of operational and other tests and a statement of whether observed performance complies with requirements.

4. Statement whether conditions, products, and installation will affect warranty.

5. Other required items indicated in individual Specification Sections.

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

1.9 QUALITY ASSURANCE

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

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

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

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

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

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

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

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

G. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.

H. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least **twenty-four** [**24**] hours in advance of time when Work that requires testing or inspecting will be performed.

4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.

5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.

6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

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

J. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in pre-installation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

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

L. Testing Agency Responsibilities: Cooperate with Engineer and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Engineer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.

3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.

4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.

5. Does not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.

6. Do not perform any duties of Contractor.

M. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.

2. Incidental labor and facilities necessary to facilitate tests and inspections.

3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.

4. Facilities for storage and field curing of test samples.

5. Security and protection for samples and for testing and inspecting equipment at Project site.

N. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

O. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents **as a component of Contractor's quality-control plan**. Coordinate and submit concurrently with Contractor's construction schedule.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.

2. Description of the Work tested or inspected.

3. Date test or inspection results were transmitted to Architect.

4. Identification of testing agency or special inspector conducting test or inspection.

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

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

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

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

END OF SECTION 014000

SECTION S01500
TEMPORARY FACILITIES AND CONTROLS

1.01 REQUIREMENTS

A. The Contractor shall provide the temporary facilities and controls as hereinafter specified and as required by law.

1.02 SECURITY

A. Employee Identification

1. The Contractor shall provide photo-identification badges for all of the Contractor's employees and, in addition, require that all Subcontractors provide photo-identification badges for their employees. Badges are to be worn on outer clothing and be conspicuously displayed at all times while present on the premises of the Owner.

   a. The badge is to include the Contractor's name, the employee's name, an employee identification number, date of birth, height and weight, and a photograph of the employee. The identification number shall correspond to the employee's social security number.

   b. The Contractor shall maintain an internal record of each such employee identification number and the social security number to which it corresponds. The social security number shall not be displayed on the badge.

2. The Contractor is hereby notified that any employee of the Owner or any law enforcement agency shall have the right to inspect identification badges. If the Contractor's employee refuses to display or produce a badge for examination, the Owner shall be notified and the Contractor may be directed to remove the employee from the premises.

B. No visitors shall be permitted on the Site without prior approval by the Owner.

1.03 TEMPORARY LIGHTING, POWER AND ELECTRIC SERVICE

A. General

1. The Contractor shall provide, maintain, and pay for all temporary lighting and power required, including exterior lighting and security lighting, in connection with the Contractor's operations from the commencement of the Work until the completion of the project or for such other time as directed by the Owner. When the use of such temporary lighting and power is no longer required, all temporary wiring and equipment shall be completely removed by the Contractor.

2. The Contractor shall make the necessary application to the utility company and pay for all charges, costs and expenses incidental to the installation and maintenance of temporary lighting and power as required in connection with the Contractor's operations, and the Contractor shall pay for all power used.

3. The required temporary lighting must be maintained for twenty-four (24) hours a day and seven (7) days a week at all stair levels and in all corridors below ground; in all other spaces temporary lighting is to be maintained only during working hours.

4. All temporary wiring and equipment shall be in conformity with the New York City Electrical Code. Three-phase temporary power circuits shall be installed as required to operate construction equipment of the various trades and to install and test equipment and operate as required for construction purposes such as pumps, mechanical equipment and elevators.

5. All temporary lighting shall use high-efficacy lamps as required by Section BC 3303.2.3.1 of the 2014 NYC Building Code (Local Law 18/2014).

B. Minimum Illumination

1. The minimum illumination permitted at any time, anywhere within and outside of the Building, shall not be less than the requirements of the Labor Law Dept. of Labor, State of N.Y. or OSHA or any other agency having jurisdiction, but in no case less than 20 FC average and no less than 2 FC at any point.

2. The minimum lighting requirement anywhere about the site shall be 2 FC average and 0.5 FC minimum at any point.

3. If the Owner's Representative decides that the temporary illumination within the building, or on adjacent site is unsatisfactory, the Contractor shall:

a. Provide additional lighting units in designated areas.

b. Increase the number of lighting units in simultaneous operation.

C. Temporary on Site Exterior Security Lighting System

1. Provide a temporary on-site exterior security lighting system for prevention of vandalism and thefts during the course of construction.

2. The security lighting system must be completely installed and operating at the earliest possible date as directed by the Owner.

3. A plan detailing the layout of all trailers and the site lighting shall be provided along with the Temporary Lighting Submittal.

4. Minimum lighting shall be 2 FC average and 0.5 FC minimum at any point.

1.04 TEMPORARY WATER

A. Furnish and pay for water used for temporary service as described herein. Make all arrangements for such water with the agency having jurisdiction and provide special metering and piping if required.

B. Provide and maintain a temporary water system of size and capacity as required to supply the needs of all contractors for the Work.

C. Provide no less than two 3/4" hose bibs conveniently located.

D. Provide and pay for all connections and permits.

E. Provide such temporary water system so that service shall be available at the commencement of the Work. The permanent water risers and lines may be used for temporary water supply. The permanent services shall be turned over to the Owner in perfect condition. Any repairs required due to temporary use shall be made at the sole expense of the Contractor.

F. Provide a line of adequate size to the temporary toilet facilities if such facilities require water.

G. Protect temporary and permanent lines against any damage.

H. Prevent water damage to the Work.

I. Remove all temporary lines when directed by the Owner's Representative when such lines are no longer required.

1.05 TEMPORARY TOILET FACILITIES

A. The Contractor shall provide, stock, and maintain toilet accommodations for all persons employed or engaged in the Work; such facilities shall meet any and all requirements of law, rule or regulation. The Contractor shall remove such facilities at the completion of the Work or at such earlier time as the Owner's Representative may direct.

B. Provide one chemical toilet unit adjacent to the security guard's station for the Owner’s use or as directed by the Owner.

C. If, upon the approval and direction of the Owner's Representative, a toilet room in a station building is used as a temporary toilet facility, such temporary toilet facility shall be maintained in a sanitary condition by the Contractor. In all permanent toilet

rooms, all plumbing fixtures and room finish shall, upon completion of the Work, be free from any damage, defacement or other defects. The cost of any necessary repair or replacement shall be borne by the Contractor.

D. Sanitary Facilities

Sanitary facilities shall be provided during construction, remodeling, or demolition activities in accordance with the 2008 New York City Plumbing Code.

1.06 FIRE WATCH DURING CONSTRUCTION

A. A Fire Watch shall be provided for the following conditions:

1. When open flame or spark-producing tools and equipment such as heating kettles, blow torches and welding rods are being used, the Contractor shall provide personnel engaged for fire watch purposes (fire guards) to maintain a fire watch over the operation of these items at all times during the use and until all materials have cooled sufficiently to no longer constitute a fire hazard. Provide additional fire guards required by the FDNY as determined by the FDNY inspector after Work is under way.

2. When the work includes installation of, replacement of, or modification to an existing Fire Alarm system and its operation is required for use of the building but the new or modified system has not yet been accepted by the FDNY, the Contractor shall provide fire guards to maintain a fire watch. Provide the number of fire guards required by the FDNY for the size of the building during the times and at the locations as directed by the Owner.

1.07 TEMPORARY FENCE ENCLOSURES

A. The Contractor shall provide and maintain temporary fence enclosures required by the Contract.

B. Provide a construction fence as required, with construction in accordance with the NYC Building Code. Paint fence one coat of paint in color selected by the Owner.

C. A safety zone approved by the DOB shall be provided around the demolition area as shown on the site safety plan. Fences shall be erected to prevent persons other than workers from entering. They shall be at least 8 feet high, solid, with clear 1/4” thick polycarbonate plastic panels at viewing openings.

D. Develop, and submit to the Owner for approval, a detailed fence plan, indicating bracing, gates and other pertinent information.

1.08 MAINTENANCE OF PARKING AREAS

A. The Contractor shall maintain parking areas for the use of those engaged in the Work; such maintenance shall include, but not be limited to, the removal of snow.

1.09 STAGING AREAS

A. The Owner may, at its discretion, designate temporary staging areas for the Contractor for such purposes as storage of materials, erecting a field office. The staging areas shall be determined by the Owner at the bid award. Provide fencing and secure in-swinging gates to fully enclose the areas and prevent unauthorized entry. Fences and gates shall be at least 8 feet high unless directed otherwise by the Owner. Submit drawings of the staging areas to the Owner for prior approval, indicating locations of all facilities and details of fences and gates. Maintain the areas and facilities in safe, clean, and orderly condition. As per Section BC 3307.4.7, the barrier for storage areas adjacent to pedestrian paths shall be solid for at least 4'-0" in height. In the area where a material hoist is located, the solid protection shall extend from the ground level to the height of the overhead protection.

B. When directed by the Owner, remove temporary staging area facilities, repair all damage, and finish the area as directed.

1.10 WATER CONTROL

A. The Contractor shall provide, maintain and operate pumps required to keep the Work free of water at all times.

B. The Contractor shall:

1. Provide, maintain and operate pumps as required to keep all exterior work free of water at all times. The Contractor shall comply with all NYSDEC, NYCDEP and DOB requirements for water management and disposal. When required the contractor shall pay for all fees and file all required applications in order to facilitate such operations.

2. Dispose of all water with due care and shall not infringe on the rights of others on the Site, of adjacent property owners and of the public. All cost in connection with the removal of such water shall be paid by the Contractor.

C. Drainage

1. No condition shall be created as a result of construction or demolition operations that will interfere with natural surface drainage.

2. Water courses, drainage ditches, etc., shall not be obstructed by refuse, waste building materials, earth, stones, tree stumps, branches, or other

debris that may interfere with surface drainage or cause the impoundment of surface waters.

3. All excavations shall be drained and the drainage maintained as long as the excavation continues or remains. Where necessary, pumping shall be used, provided proper permits are obtained from the New York City Department of Environmental Protection.

1.11 POLLUTION CONTROL

The Contractor shall:

A. Comply with all laws, rules and regulations governing pollution control, including but not limited to those of the Department of Environmental Conservation of the State of New York.

B. Take all necessary precautions including, but not limited to digging and maintaining settling basins and dams; diverting streams, and taking all other actions that may be necessary to prevent silt, and waste of any kind from being deposited, silting and reduction of quality of streams below the construction area and downstream properties as a result of the Work.

C. Refrain from the disposal of volatile fluid wastes into storm or sanitary sewer systems, approved sewage disposal systems or any waterway.

D. Refrain from burning trash or waste materials.

1.12 TEMPORARY FIELD OFFICES

A. Contractor's Field Office

1. The Contractor shall provide for its use all temporary office facilities necessary for the performance and management of the construction. Such facilities must be in place and in operation within thirty (30) days of the start date indicated on the NTP. No space within the existing building will be provided to the Contractor for such temporary offices unless otherwise indicated. Contractor’s field office shall be made of metal or other noncombustible material.

2. The Contractor must obtain written approval from the Owner for any temporary facility located on the site. The Contractor shall relocate such temporary office facility to other locations, approved by the Owner, as necessary to facilitate the expeditious completion of the Work at no additional cost to the Owner.

3. Temporary toilet and sink shall be connected to an approved sewage disposal system.

1.13 PROJECT IDENTIFICATION

A. Project identification signage construction and location shall meet the latest requirements of Section BC 3301.9.

B. Project Identification signs will be furnished by the Owner. The signs will be delivered to the site by the Owner's vendor and installed by the Contractor at the locations required by the Building Code.

1. The Contractor shall provide a suitable frame for the sign and shall erect sign, providing required supports, bracing, and painting of frames, supports and bracing, all at the expense of the Contractor.

2. Countersink all nails and screw heads after erection; fill holes and touch-up paint.

3. The content of the sign shall not be obscured, defaced or disfigured by panel attachments, including grommets or grommet holes.

C. Maintain the sign for the duration of the Work of the Project as per **Section** BC 3301.9:

1. Panels are to remain legible and good structural condition, securely attached, level, plumb, and free of sharp edges, protruding nails and similar hazards.

2. If deemed necessary, in the opinion of the Owner, repaint all or portions of the sign (except for lettering and artwork), supports and appurtenances, at the Contractor's expense.

D. No other signs or advertisements shall be displayed on the Site, except as required by the Contract or required by Building Code.

1.14 RODENT AND PEST CONTROL

A. During the Work, Contractor shall provide rodent and pest control. A licensed exterminating company, with minimum of 10 years of successful experience, shall keep the premises free of rodents, pests, insects, and vermin.

1.15 TREE PROTECTION

A. Provide adequate protection for the duration of the Project Work for existing trees which are to remain at the Site. Contractor shall bear the expense of replacing trees that are damaged.

B. No trees outside the property line within the public right of way shall be disturbed or removed without the permission of the Commissioner of the Department of Parks and Recreation. Protection shall be provided around the trunks of all trees with written notification at least 48 hours prior to commencement of such work. Such trees shall be protected pursuant to the requirements of the Department of Parks.

C. Provide photos of trees prior to beginning construction operations, including installation of bridging and sheds. Engage an ISA Certified Arborist to develop plans and supervise the protection of the trees.

1.16 SCAFFOLDING

A. General:

1. The Contractor shall furnish and securely set scaffolds required for the Work.

2. All scaffolds shall be of good, sound materials, of adequate dimensions for its intended use and substantially braced and tied to ensure absolute safety for its users, station personnel, and the public.

3. Scaffolds shall be in conformance with the requirements of the New York City Building Code and all laws and regulations having jurisdiction.

B. Exterior Scaffolding

1. Suspension Scaffolds:

Suspension scaffolds are not permitted. Scaffold platforms suspended by ropes or other non-rigid means from overhead are prohibited.

2. All Other Types of Scaffolds (Supported Scaffolds):

a. Supported scaffolds shall have a completely rigid supporting system, transferring all vertical loads to the ground, sidewalk shed, or building structure below.

b. Scaffolds shall be filed by the Contractor with the Owner’s Facilities Inspection Division. All applications shall be submitted by a licensed professional Engineer or Architect.

c. Scaffolds shall be checked by a licensed Professional Engineer hired by the Contractor, who shall inspect and certify that scaffolds installed comply with the manufacturer's specifications and the New York City Building Code and all laws and regulations having jurisdiction and are safe to perform the Work of the Contract. The Contractor shall submit such certification to the Owner and display a copy at the job site for verification.

d. Scaffolds shall not be anchored to the outer wythe of masonry walls for lateral bracing.

e. Lateral bracing shall be anchored by one or more of the methods described in subparagraphs 1), 2), or 3), below. Prior to erection of the scaffolds, the Contractor shall submit the method(s) to the Owner for review and approval. The submittal shall be prepared, signed and sealed by a Registered Architect or licensed Professional Engineer, and this Architect or Engineer shall certify the structural adequacy of all anchorage methods to be utilized for the Project.

1) Provide anchorage through the outer wythe of masonry into the second wythe of masonry. The existing wall must be of solid masonry construction.

2) Secure scaffolds to the building structural steel or reinforced concrete member.

3) If the Contractor finds an alternate method of bracing preferable, the Contractor shall submit the proposed alternative method, certified by the Contractor's Architect or Engineer, to the Owner for review and approval.

f. The Contractor shall be responsible for the stability and safety of the scaffolds and anchorage until their removal, and for restoration of the entire wall where damaged or disturbed by bracing.

1.17 SIDEWALK SHEDS, PROTECTIVE SHEDS, FENCES, CHUTES, ETC.

A. Provide and maintain sidewalk sheds and on-site protective sheds as specified in Section S01535 - Safety Program.

B. Sidewalk sheds, on-site protective sheds, fences, railings, over-the-sidewalk chutes, and other such temporary facilities shall be filed by the Contractor with Department of Buildings (DOB) and shall meet the requirements for design and color as required by Section BC 3307. All applications shall be submitted by a licensed professional Engineer or Architect. Include all required design and location information as required by Section BC 3307 on the filed documents. Notify the Department of Buildings within two days of removing sheds.

C. Sidewalk sheds and on-site protective sheds shall be constructed to provide complete, continuous protection as required by applicable regulations and the Contract Documents, without gaps or openings between protective elements, or between the shed and the face of building where the shed abuts the building.

D. Provide vandal resistant light fixtures with wire guard, and with self-ballasted compact fluorescent lamps or LED lamps. Provide and maintain temporary lighting

at all times, inspecting daily at a minimum. Make repairs due to vandalism and replace burned out lamps immediately.

1. Temporary lighting wiring shall be run in rigid galvanized conduit (RGC). The conduit shall be run exposed and secured, in an approved manner, below the shed. The Contractor shall provide branch circuit wiring from a panel in the building and run three THW conductors (Black-White-Green) per circuit. Core drill (2") the conduit entrance into the building and insert a 1½" threaded sleeve. The Contractor shall remove the conduit and wires and place a threaded cap on the sleeve thru the building after temporary lighting is removed. Sidewalk shed plans submitted shall include type of fixtures, type and rating of light source, horizontal spacing of fixtures, vertical height above sidewalk, and type of conduit.

2. All temporary wiring shall be installed in accordance with the requirements of the Bureau of Electrical Control as per NYCDOB Policy Notice 99-9. A temporary certificate of inspection issued by that Bureau shall be obtained by the Contractor and delivered to the Owner's Representative.

3. As per Section BC 3307.6.4.8, all lamps shall have a minimum luminous efficacy of 45 lumens per watt or greater and be rated to operate at temperatures of 5°F and higher.

4. Provide a minimum of 2 foot-candle measured at the level of sidewalk walking surface. Photosensors shall be utilized to control lighting according to the amount of daylight available and shall be equipped for fail-safe operation such that if they fail, the lamps will provide the required lighting levels.

E. Tamper-Resistant Fasteners: All fasteners and connections used in the construction of sheds shall be tamper-resistant type. Tamper-resistant fasteners shall be used in such manner as to prevent unauthorized removal or loosening of any part of the shed. Specialized tools shall be required for removal.

1. Provide tamper-resistant fasteners for connection of all components and materials of the shed, including but not limited to pipe bracing, pipe railings, beam clamps, couplings, outriggers, extensions, protective guards, and enclosure walls built around the perimeter of the shed deck. Non-tamper resistant nuts, bolts, screws, nails, and pins are prohibited unless used in conjunction with a device which makes the entire connection assembly tamper-resistant.

2. Bolts shall have tamper-resistant heads or shall be welded to prevent removal. Screws shall have tamper-resistant heads such as Torx or socket security hex head with center pin.

3. Tamper-resistant nuts

   a. Nuts shall be conical shape with multiple slots, requiring specialized socket tool for installation and removal. Corrosion resistant zinc alloy (Zamac 5 - AC41A). Compressive strength, 87,000 psi. Shear strength, 38,000 psi. Impact strength (CHARPY), 48 ft.lbs. Hardness BHN, 91. Size and threads as required to suit studs and bolts. Remove all sharp edges. Manufacturers:

      1) Trident Tamper-Resistant Nuts; Tanner Bolt & Nut Corp., 4302 Glenwood Road, Brooklyn, NY 11210. Telephone 718 434-4500.

      2) Trigroove Tamper-Resistant Nuts; Fastenal Company, Farmingdale, NY. Telephone 516 391-0980.

   b. Provide zinc plated hex nuts, cylindrical spacers, and/or washers beneath tamper-resistant nuts where required for a proper connection. Fully tighten the entire assembly for tamper resistance. The diameter of the tamper-resistant nut shall not exceed the outside dimension of a hex nut or spacer beneath it, in order to prevent unauthorized removal.

   c. Fully tighten all fasteners. Wherever a standard nut is used it shall be fully tightened and a tamper-resistant nut shall be installed over it to prevent unauthorized removal. Where through bolts or rods are used, provide tamper resistant devices at both ends, or weld one end to prevent turning.

F. Provide all required daily and periodic inspections as required by Section BC 3307 and maintain protective in good working order.

G. Protection of adjoining roofs shall meet the requirements of Section BC 3309.10. Protection of adjoining windows shall meet the requirements of Section BC 3309.14.

H. Protect all unenclosed openings for the duration of the project in accordance with Section BC 3308.

END OF SECTION

SECTION 015350- SAFETY PROGRAM

1.01 SAFETY PROGRAM REQUIREMENTS

A. Establish and implement a Site Safety Program to ensure protection of persons and property on the Site and surrounding areas.

B. As part of the Site Safety Program, prepare a Site Safety Plan.

C. The Site Safety Program shall be in compliance with the most stringent requirements of the Owner's Site Safety Manual; the 2014 New York City Building Code including, but not limited to, Chapter 33 entitled “Safeguards During Construction or Demolition”; the New York City Fire Code and other codes and regulations having jurisdiction. As part of the Site Safety Program, provide additional precautions and safeguards as indicated on the Drawings, as specified herein, and where required for proper protection of persons and property.

1.02 SUBMITTALS

A. Site Safety Plan

1. Submit for review a Site Safety Plan to the Owner’s Engineering Unit within 5 days of Notice to Proceed (NTP).

2. The Site Safety Plan shall be prepared, signed and sealed by a N.Y.C. licensed Site Safety Manager certified by the New York City Department of Buildings.

3. The Site Safety Plan shall include, but not be limited to, the following:

   a. Complete plans of the entire site, including building interiors, areas inside the property line, and surrounding areas outside the property line.

   b. Location of sidewalk sheds, fences, egress ways inside the building, sanitary facilities, scaffolding, fire protection, demolition safety zone and all other required elements. Indicate all areas of the building, site and surrounding areas that will be impacted by the Work. Show temporary facilities, equipment, work areas, storage areas, contractor's access ways, and all locations where the public or occupants may be affected in the course of the Work.

   c. Separate drawings for multiple phasing periods, if applicable.

4. Conduct all inspections and probes necessary to determine the impact of the Work on areas adjacent to, and above or below the Work areas. Include all affected areas in the Safety Plan.

1.03 COORDINATION AND SAFETY MEETINGS

A. When directed by the Owner's Representative, attend a meeting with the Owner to coordinate the Safety Program with Station functions and the construction schedule.

B. Schedule and attend all safety meetings as described in the Owner's Safety Manual. Safety meetings shall be held at least once per week.

1.04 SAFETY FACILITIES AND CONTROLS

A. Provide and maintain all temporary facilities and controls required for implementation of the Site Safety Program.

B. Provide sidewalk sheds where indicated in the Contract Documents, where required by law, and wherever the Work has the potential of creating an overhead hazard that could lead to serious injury or death.

C. Unless approved in writing by the Owner, sidewalk sheds, on-site sheds, and fences shall not be dismantled or relocated as work proceeds at various locations of the building. All protection shall remain in place at all times until the Owner's Representative directs its removal in writing.

D. Protective sheds located within the property line, on-site, for protection from overhead hazards shall be constructed in the same manner as required by Code and the Contract Documents for sidewalk sheds and shall have the same auxiliary elements including electrical lighting.

E. Where overhead protection is required, partial closing of sidewalks or streets will not be permitted. Proper protection shall be provided by means of sidewalk sheds or full street closing. Full street closing shall include the street and the sidewalks on both sides of the street.

F. Protect all unenclosed openings for the duration of the project as required by Section BC 3308 of the 2014 NYC Building Code.

1.05 CORRECTION OF SAFETY DEFICIENCIES

A. No unsafe condition shall be left uncorrected.

B. Where a deficiency noted during a safety inspection does not entail the existence of a hazardous condition, the maximum time for correction of the deficiency shall be 24 hours, except where a shorter response time is required by the Owner's Safety Manual, other Contract Documents, local regulations, or the Owner's Representative. New York City Fire Department inspection deficiencies and all hazardous conditions shall be acted upon immediately and corrected before leaving the site.

END OF SECTION

SECTION 016000 - PRODUCT REQUIREMENTS

1.01 ACTION SUBMITTALS

A. Comparable Product Requests: Architect will notify Contractor of approval or rejection within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information.

1.02 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Use means and methods that will prevent damage, deterioration, and loss, including theft.

B. Store products to allow for inspection and measurement or counting of units.

C. Provide for storage of materials and equipment by Owner.

1.03 PRODUCT WARRANTIES

A. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

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

1.04 PRODUCT SELECTION PROCEDURES

A. Product Selection Procedures:

1. Product: Product named that complies with requirements.

2. Manufacturer/Source: Product by manufacturer or from source named that complies with requirements.

3. Products: One of the products listed that complies with requirements. Comparable products will be considered unless otherwise indicated.

4. Manufacturers: Product by one of the manufacturers listed that complies with requirements. Comparable products will be considered unless otherwise indicated.

5. Basis-of-Design Product: Either the specified product or a comparable product by one of the other named manufacturers.

6. Visual Matching Specification: Product that matches Architect's sample. Architect's decision will be final.

7. Visual Selection Specification: Product (and manufacturer) that complies with other specified requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

1.05 COMPARABLE PRODUCTS

A. Conditions for Consideration:

1. Product does not require revisions to the Contract Documents, is consistent with the Contract Documents and will produce the indicated results, and is compatible with other portions of the Work.

2. Comparison of proposed product with those named in the Specifications.

3. Product provides specified warranty.

4. Similar installations, if requested.

5. Samples, if requested.

END OF SECTION

SECTION 017300 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

B. Related Requirements:

1. Section 011000 "Summary" for limits on use of Project site.
2. Section 013300 "Submittal Procedures" for submitting surveys.
3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other related work.

B. Patching: Fitting Fire stopping and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

A. Cutting and Patching Plan: Submit plan describing procedures at least (**10**) **ten** days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.

2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.

3. Products: List products to be used for patching and firms or entities that will perform patching work.

4. Dates: Indicate when cutting and patching will be performed.

5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

1.5 QUALITY ASSURANCE

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

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

a. Primary operational systems and equipment.
b. Fire separation assemblies.
c. Air or smoke barriers.
d. Fire-suppression systems.
e. Mechanical systems piping and ducts.
f. Control systems.
g. Communication systems.
h. Fire-detection and -alarm systems.
i. Conveying systems.

j. Electrical wiring systems.
k. Operating systems of special construction.
l. Equipment supports.
m. Piping, ductwork, vessels, and equipment.
n. Noise- and vibration-control elements and systems..

B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

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

1. For projects requiring compliance with sustainable design and construction practices and procedures.

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

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

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

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

2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.

3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.

2. List of detrimental conditions, including substrates.

3. List of unacceptable installation tolerances.

4. Recommended corrections.

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

3.2 PREPARATION

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

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

C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Engineer according to requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

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

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

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

1. Do not change or relocate existing benchmarks or control points without prior written approval of Engineer. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Engineer before proceeding.

2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points..

3. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

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

1. Make vertical work plumb and make horizontal work level.

2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement..

3. Maintain minimum headroom clearance of **96 inches (2440 mm)** <**Insert dimension**> in occupied spaces.

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

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

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

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

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

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

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

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Engineer.

2. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.Insert additional installation requirements to suit Project. See Evaluations.

3.6 CUTTING AND PATCHING

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

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

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

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

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

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."

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

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

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

3. **Concrete and Masonry**: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

5. Proceed with patching after construction operations requiring cutting are complete.

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

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

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

3.7 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.

2. Pre-installation Conferences: Include Owner's construction personnel at pre-installation conferences covering portions of the Work that are to receive Owner's work. Attend pre-installation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

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

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.

2. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

a. Use containers intended for holding waste materials of type to be stored.

3. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

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

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

1. Remove liquid spills promptly.

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

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

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

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

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

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

3.9 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."

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

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

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

E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

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

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

END OF SECTION 017300

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SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

B. Related Requirements:

1. Section 017300 "Execution" for progress cleaning of Project site.
2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.3 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

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

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

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

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

1.6 SUBSTANTIAL COMPLETION PROCEDURES

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

B. Submittals Prior to Substantial Completion: Complete the following a minimum of **ten** (**10**) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.

3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Engineer Label with manufacturer's name and model number where applicable.

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

5. Submit test/adjust/balance records.

6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of **ten** (**10**) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.

2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.

3. Complete startup and testing of systems and equipment.

4. Perform preventive maintenance on equipment used prior to Substantial Completion.

5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."

6. Advise Owner of changeover in heat and other utilities.

7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.

8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.

9. Complete final cleaning requirements, including touchup painting.

10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of **ten** (**10**) days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by engineer, that must be completed or corrected before certificate will be issued.

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

2. Results of completed inspection will form the basis of requirements for final completion.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."

2. Certified List of Incomplete Items: Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by engineer. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.

4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

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

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

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

1. Organize list of spaces in sequential order..

2. Include the following information at the top of each page:

a. Project name.
b. Date.
c. Name of Engineer
d. Name of Contractor.
e. Page number.

3. Submit list of incomplete items in the following format:

a. MS Excel electronic file. Engineer will return annotated file.
b. PDF electronic file. Engineer will return annotated file.
c. **Three (3)** paper copies. Engineer will return **two** copies.

1.9 SUBMITTAL OF PROJECT WARRANTIES

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

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

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.

2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.

3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

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

PART 2 - PRODUCTS

1. allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

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

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

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

    a. Clean Project site in areas disturbed by construction activities, including of rubbish, waste material, litter, and other foreign substances.
    b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    c. Remove tools, construction equipment, machinery, and surplus material from Project site.
    d. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    e. Remove debris and surface dust from limited access spaces, including plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    f. Sweep concrete floors broom clean in unoccupied spaces.
    g. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
    h. Remove labels that are not permanent.
    i. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    j. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
    k. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
    l. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

        1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.

    m. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
    n. Leave Project clean and ready for occupancy.

3.2 REPAIR OF THE WORK

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

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be

repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.

2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

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

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

END OF SECTION 017700

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SECTION 020600 - ELEVATOR TOWER DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide all labor, equipment and materials as required for the complete demolition and removal of the subject building(s), including, but not limited to, the following:

1. Demolition of entire elevator tower, and equipment, including floor slabs and foundation walls; basement foundation walls (as indicated on the Drawings), basement floors slabs, and footings.

2. Demolition of exterior steps, stone walls, concrete curbs, concrete sidewalks, concrete paving, except where shown otherwise on the Drawings.

3. Prior to filling, removal of all fixtures and equipment, e.g., exposed piping, conduits, tanks, from the area.

4. Disconnecting and capping of utility lines designated for removal or abandonment.

5. Clearing of the site.

6. Removal and disposal of all demolished materials, rubbish, and debris.

B. All demolition, removal, and disposal Work shall be in compliance with the requirements of the Building Code of the City of New York and with all State and Federal regulations.

C. For earth fill and grading of site, see Section 022010.

1.2 REFERENCE STANDARDS

A. References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

B. National Association of Demolition Contractors (NADC) - Demolition Safety Manual, latest edition.

C. All applicable OSHA requirements and other Federal, State, and local codes, laws, ordinances, regulations, and guidelines for demolition and related work.

1.3 APPLICATION FOR DEMOLITION AND REMOVAL PERMITS

A. Asbestos abatement is to be completed prior to application for demolition permits.

B. Apply for permits in accordance with Chapter 1 of Title 28 of the NYC Administrative Code, Article 105, and Section BC 105.6 of the 2014 NYC Building Code.

1.4 SUBMITTALS

A. Shop Drawings

1. Submit shop drawings and associated calculations for sheeting, shoring, bracing and underpinning. Shop drawings and calculations shall be signed and sealed by a Professional Engineer licensed in the State of New York and Design Drawings of such shall be filed with the Building Department.

2. Submit shop drawings and associated calculations for Mechanical Demolition. Mechanical demolition drawings and sequencing shall be signed and sealed by a Professional Engineer licensed in the State of New York and Design Drawings of such shall be filed with the Building Department.

B. Schedule

1. Demolition sequence schedule: Submit a schedule indicating proposed methods and sequence of operation for demolition and removals to the RIOC's Representative for review prior to commencement of Work.

2. Insect and rodent control scheme

3. Pollution Control Scheme: The Contractor shall submit a pollution control plan not more than 30 days prior to the commencement of demolition work. The plan shall outline proposed methods for dust control, noise control and maintaining the surrounding streets and buildings in a clean condition for both demolition operations and during debris removal. The plan shall be subject to review and approval by the RIOC.

C. Quality Control Submittals

1. Reports

a. Existing Conditions Survey: Submit existing conditions survey consisting of various data described in Article 3.02 of this Section.

b. Monitoring and Vibration control Final Report

2. Certificates

a. Bureau of Water Supply certificate stating utility has been properly capped off.

b. Bureau of Sewers certificate stating utility has been properly capped off.

c. Gas Utility Company certificate stating utility has been properly capped off.

3. Contractor Qualifications

a. Provide proof of Contractor and Professional Engineer qualifications specified under “Quality Assurance”.

b. Provide proof of Refrigerant Recovery Technician qualifications

D. Signed receipt for salvaged items delivered to the RIOC.

1.5 QUALITY ASSURANCE

A. Qualifications

1. Company specializing in performing the Work of this Section shall have a minimum of 3 years’ experience and shall have worked on 3 projects of similar size.

2. Preparation of details of sheeting, shoring, bracing and underpinning, as well as mechanical demolition, shall be under the direct supervision of and bear the seal of a Licensed Professional Engineer of the State of New York experienced in the design of such work, who shall also be responsible for construction supervision of such.

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

B. Regulatory Requirements

1. Work of this Section shall conform to all requirements of the NYC Building Code and all applicable regulations and guidelines of all governmental authorities having jurisdiction, including, but not limited to, safety, health, and

anti-pollution regulations. Where more stringent requirements than those contained in the Building Code or other applicable regulations are given in this Section, the requirements of this Section shall govern.

2. Work outside the street line shall conform to the requirements of the governmental authorities or utilities having jurisdiction (i.e. DOT, DEP, etc.). Where more stringent requirements than those provided by the applicable governmental RIOC are given in this Section, the requirements of this Section shall govern.

3. Conform to the requirements of "Safety and Health Standards, Subpart P - Excavations, Trenching and Shoring" - OSHA.

1.6 CONDITION OF PREMISES

A. The Contractor shall accept the existing conditions of the premises and shall clear the site, as specified. The RIOC assumes no responsibility for the condition or the contents of the building(s) on the premises covered by these Specifications, nor the continuance in the condition existing at the time of the Invitation for Bids or thereafter. All damage or loss, whether by reason of fire, theft, or by other casualty or happening, to the building(s) covered by the Specifications shall be at the risk of the bidder from and after the date of award of Contract, and no such damage or loss shall relieve the successful bidder from any obligation under this Contract to complete all Work as herein provided.

B. The RIOC accepts no responsibility for existing conditions at variance with information shown on the drawings.

C. There is no guarantee by the RIOC that the number of fixtures, amount of equipment or any other material of value now existing in the building(s) to be demolished will be present in the buildings when they are demolished. The Contractor shall have no claim against the RIOC because of the absence of such fixtures and materials.

1.7 MAINTENANCE OF TRAFFIC

A. The Contractor shall conduct demolition operations and removal of debris in a manner that ensures minimum interference with streets, sidewalks and other adjacent areas, existing buildings or facilities or those under construction.

B. Do not close or obstruct streets, sidewalks, alleys or passageways, unless there shall have been first obtained all necessary municipal or other local permits therefor. Store or place no materials whatsoever in streets, alleys or passageways. Conduct operations as to interfere as little as possible with the use ordinarily made of any roads, streets, driveways, alleys, sidewalks, and other means of access and egress.

C. The Contractor shall provide, and maintain, at Contractor's own expense, all lights, barriers, sidewalk sheds, and other items that are required by traffic regulations or local law.

PART 2 - PRODUCT

2.1 MATERIALS

A. Restricted Material

Remove all debris not explicitly designated to be salvaged (to remain) from the premises and legally dispose of away from premises, except where permitted by paragraph B below. The expense of removing such material, and the value thereof, shall be taken into consideration at the time of making the bid.

B. Reuse of Clean Masonry and Concrete

Clean masonry and concrete in small pieces, resulting from the demolition of the building, may be used as fill. The pieces shall be broken into 4” maximum size units. This fill shall be leveled off evenly, to within 6" of final grade. The remaining fill shall be clean earth as specified in Section 02200.

C. Fill and Backfill

Refer to Section 022010.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to commencing demolition Work, do the following:

1. Thoroughly inspect and examine the building and premises for any hazardous materials. If any asbestos or other hazardous material is found other than what is included in the Contract and was to be removed as per other Sections, notify the RIOC immediately and do not commence the Work until receipt of written notification from the RIOC. Comply with all applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution. Refer to Section 02081 for the removal of asbestos, which is to occur prior to the demolition Work.

2. Visually inspect and photograph the adjacent areas, and structures and appurtenances of the surrounding properties. Record the existing conditions; submit all information to the RIOC's Representative.

3. Thoroughly examine the building for any of the following: Historical artifacts, including cornerstones and their contents; plaques and tablets; and other remaining articles of historic significance. If any is found (either prior to commencing demolition or during demolition Work), carefully remove, clean, and deliver to the RIOC's Representative. These items will be retained by the RIOC.

4. Before demolition has commenced, the RIOC's Representative, along with the Contractor, will inspect the building(s) and the premises and identify equipment, materials, and items desired to be retained by the RIOC in addition to those items already indicated to be salvaged. The Contractor shall remove such equipment, materials and items either before demolition or during the process of the Work and store and protect on the Site in a location designated by the Representative.

5. Items of salvageable value that are not desired to be retained by the RIOC or the RIOC are to become the property of the Contractor and may be removed from the structure as Work progresses. Transport salvageable items from site as they are removed. Storage or sale of removed items on site will not be permitted.

6. As per Section BC 3306.3.1, no demolition operations shall commence unless the Contractor or permit holder notifies the Department of Building via phone or electronically within 24 to 48 hours prior to the commencement of such work. The Contractor shall preserve and protect from damage any adjoining structures.

7. As per Section BC 3306.3.2, the Contractor shall provide written notice to owners of adjacent building not less than 10 days prior to the scheduled starting date of demolition. The written notice shall describe the work, timeframe and schedule and contact information of the contractor and of the department. No demolition shall commence until the Contractor has documented the existing conditions of all adjacent buildings in a pre-construction survey.

3.2 PREPARATION AND PROTECTION

A. Employ a certified exterminator and treat building(s) in accordance with governing regulations for rodent and insect control. Submit certificate to the RIOC.

B. Protect structures, underground utilities and other construction to remain from damage caused by demolition operations. If unmarked or unknown utilities are uncovered during excavation, notify the RIOC and the Engineer of Record to receive further instructions prior to proceeding further. Should damage to adjacent construction or utilities occur due to Work under this Section, all costs in connection with the repair of such damage and the restoration of damaged construction to its original condition shall be borne by the Contractor.

C. Protect materials and surfaces and structure, which are to remain, from damage; if damage occurs, repair or replacement shall be made by the Contractor, to the satisfaction of the RIOC, and at the expense of the Contractor.

D. Monitoring and Vibration Control

1. Provide surveyed elevation benchmarks and accelerometers on adjacent structures before commencing work when structures are adjacent to demolition operations. Record and report elevation of each benchmark daily. Monitor accelerometers regularly while each heavy demolition is proceeding.

2. Should benchmark readings indicate displacement or accelerometers exceed normally acceptable limits for particle velocity (maximum allowable peak particle velocity at the lot line shall be 0.5 inches per second), halt operations until corrective action has been provided and is acceptable to the RIOC.

3. The Contractor shall record the condition of façade elements of nearby buildings so as to establish the status of those buildings prior to the work. Record all signs of distress (eg., cracks, shifting parapets, settlement, etc. in those buildings by written description backed by photos. During the demolition operations, monitor the structures and record observations (ie., apparent changes in the condition of the buildings). If conditions are noted to be changing, revise demolition procedures. Upon completion of the demolition, submit a final report highlighting the changes in the neighboring buildings that may have been observed.

E. Protection of Adjoining Property

1. Comply with Section BC 3306.

2. The Work of demolishing the building(s) and structure(s) shall be carried on in a manner that will ensure adjacent property against any damage that might occur from falling debris or other cause and so as not to interfere with use of adjacent buildings and structures or the free and safe passage to and from the buildings and structures.

3. All work adjacent to occupied buildings that may produce fire hazards or create nuisances or safety and health hazards from noise, vibration,

gases, vapors, fumes, dust mists or odors shall not be performed unless preventive controls or measures including, but not necessarily limited to, those shown on the Contract Drawings and/or as specified within this Specification are implemented. Special attention is brought to adjacent building fresh air intakes, air conditioning units, etc., which need protection from dust during demolition. Protective procedures shall not begin until reviewed by the RIOC. Such review shall in no way relieve the Contractor from his responsibility to execute the work in a safe manner and in accordance with all applicable Federal, State and local requirements.

4. The Contractor shall take every precaution to guard against any movement or settlement of adjacent buildings, streets, sidewalks and embankments, caused as a result of this Work. The Contractor shall be solely and entirely responsible for the safety and support of such buildings, and shall be solely liable for any such movement or settlement and any damage or injury caused as a result of this Work. During demolition and grading Work, protect all existing walks that are to remain by a system of permanent shoring and bracing designed by a qualified New York State professional engineer engaged by the Contractor, at the Contractor's expense. The shoring and bracing shall be furnished and installed by the Contractor in accordance with the applicable provisions of the N.Y.C. Building Code and shall be adequately anchored and braced to resist earth and hydrostatic pressures. The system of shoring and bracing shall remain in place after completion of all work under the contract and shall be the property of the RIOC. Ensure that after all rainstorms all sides or slopes of excavations are inspected as per Section BC 3304.5.1 and safe conditions restored.

5. Shoring and Bracing

   a. The Contractor shall engage the services of a third party Registered Professional Engineer (not a direct employee) to prepare details of underpinning, bracing, sheeting, sheet piling, shoring, and other construction required for protection of excavations and support of adjacent properties or buildings. These drawings shall be submitted to the Engineer of Record for general review, which does not relieve the Contractor's Engineer of responsibility for the adequacy of the design.

   b. The Contractor's Engineer shall file Form PW-1 with the Building Department, thereby becoming the Engineer of Record for such protection work and is responsible for stability of all underpinning, slopes and bracing and for preparation of all design and shop drawings and their approval by the Building Department prior to obtaining a permit. The SCA will engage a Special Inspection Agency to perform the Special Inspection described in Sections

BC 3304.4, BC 3304.5, BC 1704.20.1, BC 1704.20.2, and BC 1704.20.3.

6. Materials: Provide shoring and bracing material that will support loads imposed. Materials need not be new, but in serviceable condition.

   If wood is part of shoring system, use approved pressure-preservative treated materials.

7. Installation

   a. Shoring system retaining earth on which the support or stability of existing structures is dependent must be left in place at completion of the Work.

      If necessary to move a brace, install new bracing prior to removal of original brace.

   b. Maintain bracing until structural elements are rebraced by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

   c. Repair or replace, as acceptable to the RIOC, adjacent Work damaged or displaced through the installation or removal of shoring and bracing work.

   d. If at any time the safety of any adjacent building or structure shall appear to be endangered, the Contractor shall cease operations, and at the Contractor's own expense, take all proper means to support such building or structure and shall not resume operations until permission has been secured in writing from the RIOC.

   e. The Contractor shall take every precaution to guard against the movement, settlement or collapse of adjacent property, and shall promptly repair such damage.

   f. Any roofing, cornice, leader pipe, or other existing arrangement for protection of a building against the elements, which is to be cut or disturbed by the removal of the adjoining building(s), is to be properly repaired and rendered serviceable for the purpose for which it is intended.

8. A safety zone approved by the Commissioner of Buildings shall be provided around the demolition area. Fences shall be erected to prevent persons other than workers from entering. They shall be at least 8 feet high, solid, with plastic panels at viewing openings.

9. The Contractor or permit holder shall notify the N.Y.C. Department of Buildings via phone or electronically at least 24 hours but no more than 48 hours prior to commencement of work and the adjoining property owner in writing not less than 10 days prior to the starting date, providing a description of the work, timeframe and schedule and contact information of the contractor and of the department.

10. Where the waterproof integrity of an adjoining wall or building has been impaired due to construction or demolition, the Contractor shall provide all necessary measures to permanently waterproof the adjoining building.

    a. All work required for structural stability and permanent waterproofing of adjacent building must be completed prior to demolition sign-off.

    b. At the completion of demolition operations, unless new construction is to follow within three months of the demolition, the site shall be graded, drained, or otherwise protected.

11. Whenever any building is to be constructed or demolished above the roof of an adjoining building, the Contractor is to protect the roof, skylights, chimneys and other roof outlets of the adjoining building from damage.

F. Salvageable Improvements

1. Carefully remove and protect all items to be saved and reused as indicated on Drawings. Replace any items that are damaged by removal at own cost.

2. Notify the RIOC in writing of any item that is damaged prior to removal so that they may ascertain the item's condition.

3. The items, equipment and materials listed in this Paragraph shall be removed and salvaged by the Contractor for future use by the RIOC.

G. Precautions

1. The work of demolition shall be carried on in every respect in a thorough and workmanlike manner. The Contractor shall provide all materials, labor and machinery necessary and shall place proper and sufficient guard and fences and warning signals by day and by night for the prevention of accidents. The Contractor shall indemnify and save harmless the RIOC, its officers, agents and servants and each of them against any and all suits and actions, claims and demands of every name and description brought against it, them, or any of them against and from all damage and costs to which it, they or any of them may be put by reason of injury to the person or property of another, resulting from negligence or carelessness in the performance of the Work, or in

guarding the same, or from any improper or defective material or machinery, implements, or appliances used in the removal of said buildings.

2. All reasonable precautions shall be taken against fire throughout all the Contractor's operations. The amount of inflammable material shall be reduced to a minimum consistent with the proper handling and storing of materials. Provisions shall be made for the extinguishing of fires, as required by the Fire Department. The Contractor shall not permit any fires to be built except as otherwise provided herein, or open salamanders to be used in any part of the Work, except those that may be required during winter weather in approved salamanders, and then only under the Contractor's continuous supervision.

3.3 DEMOLITION WORK

A. Demolition operations shall be performed in a systematic manner in accordance with Section BC 3306.

B. Do not bring explosives to site or use explosives without written consent of authorities having jurisdiction. Such written consent will not relieve Contractor of total responsibility for injury to persons or for damages to property due to blasting operations.

C. Removal, renting, transportation, storage and disposal of flammable, explosive, toxic, and corrosive substances, if any, shall be done in strict compliance with governing regulations before proceedings with building demolition.

D. Notify NYC Department of Environmental Conservation of the presence of out-of-service storage tanks in accordance with 6 NYCRR Part 613.9.

E. Demolish all of the material of the building(s), walks, entrance steps, structures, asphalt and concrete paving, apparatus, fixtures, conduits, foundation, stoops, basement slabs, railings, metal flues, storage tanks and basins on or under the site, and all such items extending beyond the building lines, except the sidewalks and curbs at street of such building. Use such methods as required to complete work within limitations of governing regulations. Fences and walls on or near property lines shall not be removed if these are used for protection or support of adjoining property.

F. Walls and foundations shall be removed in their entirety, unless indicated otherwise on the Drawings.

G. Wetting Down

1. During the demolition of the building(s), thoroughly wet down the Work to prevent any dust and dirt from rising; the Contractor shall provide water

line for this purpose and furnish all connections that may be required, at Contractor's own cost and expense.

2. Upon completion of the Work, all temporary water or other lines installed by the Contractor shall be removed by the Contractor at Contractor's own cost and expense. Do not use water when it may create hazardous or objectionable condition such as ice, flooding and pollution.

H. Utility Lines

1. Contractor shall completely remove all utilities from the existing buildings.

2. The Contractor shall withdraw and remove all abandoned water taps and old service mains and provide inserted brass plugs in the main water pipe in the streets in compliance with the rules and regulations of the Department of Environmental Protection-Bureau of Water Supply and shall furnish to the RIOC a certification from the Bureau of Water Supply certifying that this Work has been performed.

3. The Contractor shall remove all house connections to the main sewer in the streets and the openings in the main sewer shall be properly closed in compliance with the directions of the Department of Environmental Protection-Bureau of Sewers having jurisdiction in the respective Borough, and shall furnish to the RIOC a certificate from the Bureau of Sewers certifying that the Work had been properly performed.

4. The Contractor shall remove all gas services back to the main gas lines in the streets and the openings in the main gas lines shall be properly closed in compliance with the directions of the utility company having jurisdiction in the respective borough, and shall furnish to the RIOC a certificate from the utility company having jurisdiction certifying that the Work has been properly performed.

5. The permits for all openings in streets shall be obtained by and at the expense of the Contractor. The Contractor shall pay for all openings in streets and sidewalks, and for repair of such openings, and the Work shall comply with the rules and regulations of the Department of Transportation-Bureau of Highways.

6. Electric, telephone and other wires shall be disconnected in strict accordance with the rules and regulations of the Department of the City or State and of the company or companies having jurisdiction, control or ownership of such utilities. After disconnection has been completed, telephone poles located on the property shall be removed by the utility having jurisdiction over the poles.

I. Immediately remove all excess debris resulting from the operations under this Contract from the site, do not store or permit to accumulate on the site. If the

Contractor fails to remove excess debris promptly, the RIOC reserves the right to have it removed from the site at the expense of the Contractor.

J. Routine Cleaning: The Contractor shall keep adjacent streets and properties free of dirt, dust and debris produced by demolition at all times.

K. Where mechanical demolition equipment is used for demolition of a building or the removal of debris or to move material, Drawings of such work must be filed and approved with the Building Department prior to issuance of permit. The Contractor shall engage the services of a third party Registered Professional Engineer (not a direct employee) to prepare the details and sequencing of the demolition complying with all items included in Section BC 3306.5. The Contractor's Engineer shall file Form PW-1 with the Building Department, thereby becoming the Engineer of Record for such demolition work. The SCA will engage a Special Inspection Agency to perform the Special Inspection described in Sections BC 3306.6 and BC 1704.20.4.

L. When existing sprinkler systems with Siamese hose connections are present in structures undergoing demolition, they shall be maintained as a non-automatic sprinkler system. Sprinkler risers shall be capped immediately below the floor being demolished maintaining the sprinkler systems on all lower floors for Fire Department use.

3.4 DISPOSAL

A. Transport and legally dispose of materials. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.

B. Burning of wood or other material is not permitted on the site.

C. Comply with requirements for managed waste in accordance with Section S01524, Construction Waste Management.

3.5 FIELD QUALITY CONTROL

A. Inspection

1. Mechanical Demolition and the construction and installation of all underpinning, shoring and bracing required for or affecting the support and adjacent properties or buildings is subject to Special Inspection.

2. Underpinning: The Special Inspector is responsible for inspection of underpinning in accordance with Section BC 1704.20.3. Contractor’s licensed professional engineer is to file all design documents as specified in Article 3.02 of this Section.

3. Excavation - Sheeting, Shoring, and Bracing: The Special Inspector is responsible for inspection of underpinning in accordance with Sections BC 1704.20.3 and BC 3304.4.1. Contractor's licensed professional engineer is to file all design documents as specified in Article 3.02 of this Section.

4. Mechanical Demolition: The Special Inspector is responsible for inspection of Mechanical Demolition in accordance with Sections BC 1704.20.4 and BC 3306.6. Contractor's licensed professional engineer is to file all design documents as specified in Article 3.03 of this Section.

3.6 CLEAN-UP

A. Upon completion of Work under this Contract, the Contractor shall remove all tools and materials, plant, apparatus, rubbish and debris and shall leave the premises clean, neat and orderly.

END OF SECTION 020600

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SECTION 022010 - EARTHWORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Remove all items designated to be removed and excavate for new construction, fill and backfill as required, prepare subgrades and place aggregate bases for slabs, walks, and pavements. Protect existing vegetation and all adjoining properties and existing structures from damage.

1.2 REFERENCES

References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

A. American Society of Testing and Materials (ASTM) standards, latest editions.

B. New York State Department of Environmental Conservation

STARS Memo #1 Petroleum-Contaminated Soil Guidance Policy (entire part except Sections III and IV), last revised August 1992

CP-51: Soil Cleanup Guidance Policy, Issued 10/21/2010 (effective 12/3/2010)

DER-10 Technical Guidance for Site Investigation and Remediation, Issued 5/3/2010 (effective 6/18/2010)

C. New York Code of Rules and Regulations (NYCRR):

6 NYCRR Part 360, Solid Waste Management Facilities

6 NYCRR Part 364, Waste Transporter Permits

6 NYCRR Part 370, Hazardous Waste Management System – General

6 NYCRR Part 371, Identification and Listing of Hazardous Wastes

6 NYCRR Part 372, Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities

6 NYCRR Part 373, Hazardous Waste Management Facilities

6 NYCRR Part 375, Environmental Remediation Programs

D. United States Department of Transportation (USDOT):

49 CFR 172, Subpart C - Shipping Papers

49 CFR 172, Subpart D – Marking

49 CFR 172, Subpart E - Labeling

49 CFR 172, Subpart F - Placarding

49 CFR 172, Subpart G - Emergency Response Information

49 CFR 173, General Requirements for Shipments and Packagings

49 CFR 177, Carriage by Public Highway

E. United States Environmental Protection Agency (USEPA):

40 CFR Part 261, Identification and Listing of Hazardous Waste

40 CFR Part 262, Standards Applicable to Generators of Hazardous Waste

40 CFR Part 263, Standards Applicable to Transporters of Hazardous Waste

40 CFR Part 264 , Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

40 CFR Part 265, Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

F. United States Department of Labor (USDOL), Occupational Safety and Health Administration (OSHA):

29 CFR 1910, Occupational Safety and Health Standards

G. All Applicable New York City Department of Environmental Protection (NYCDEP) Rules and Regulations

H. All applicable New York City Department of Transportation (NYCDOT), Department of Sanitation (NYCDOS), Department of Buildings (NYCDOB), and Transit Authority (NYCTA) Rules and Regulations

1.3 DEFINITIONS

A. Excavation

Excavation is considered unclassified and consists of removal of material encountered to contract level, stockpiling, testing, loading, handling, transporting and subsequent legal disposal of such.

B. Improvements

Man-produced items such as concrete, brick, asphalt, piping, etc. Those items not naturally occurring.

C. Non-Hazardous Excavated Material

Material that may include or contain mixtures of the following: soil (including, but not limited to, natural undisturbed material), debris, concrete and concrete products (including steel or fiberglass reinforcing rods that are embedded in the concrete), asphalt pavement, brick, glass, rock, municipal solid waste, refuse, and incidental ash. This material includes material defined in Title 6 New York Code of Rules and Regulations 360-7.1(b)(1)(i) and will exceed 6 NYCRR 375-6 Unrestricted Use and Restricted Use Soil Cleanup Objectives and NYSDEC CP-51: Soil Cleanup Guidance Supplemental Soil Cleanup Objectives.

All material excavated from the site is assumed to meet the definition of non-hazardous excavated material.

D. Petroleum-Contaminated Material

Material (soil, concrete, sediment, UST contents, fill, debris, etc.) that meets the NYSDEC STARS Memo #1 definition of petroleum-contaminated material from known source areas. Petroleum-contaminated material shall be evidenced by the following observations and be from a known source area: producing higher than background responses on a portable vapor meter such as a photo ionization detector or flame ionization detector, petroleum-like odor, visual impacts (e.g., staining or discoloration), proximity to known releases from existing or historic petroleum storage tanks or systems, and exceed the soil cleanup levels for gasoline and/or fuel oil contaminated soil provided in the NYSDEC CP-51: Soil Cleanup Guidance. The determination as to whether the excavated material is petroleum-contaminated or is non-petroleum contaminated material will be made by analytical testing of representative material samples. All sampling shall be performed under the supervision of the RIOC's Hazmat Consultant or its representative. The Contractor shall provide the RIOC's Hazmat Consultant with qualitative and quantitative information, and the Hazmat Consultant shall make the final determination as to whether or not the material is petroleum-contaminated and the appropriate disposal.

E. Hazardous Waste

Material meeting the definition of a Resource Conservation and Recovery Act hazardous waste as defined in 40 CFR Part 261, New York State ECL Section 27-09 or 6 NYCRR Part 371.

F. Environmentally Clean Fill and Backfill

1. For fill and backfill proposed for use as cover material (landscaped areas of the site within 2 vertical feet of the final surface grade elevation), environmentally clean fill is defined as soil that has been tested utilizing methods which yield laboratory reporting limits that are below the regulatory comparison criteria and found to contain:

    a. No detectable concentrations of volatile organic compounds;
    b. No other organic compounds or inorganic analytes at concentrations above 6 NYCRR 375-6 Unrestricted Use Soil Cleanup Objectives; and
    c. No other organic compounds or inorganic analytes at concentrations above the lower of the NYSDEC CP-51: Soil Cleanup Guidance Residential Use, Protection of Ecological Resources, and Protection of Groundwater Supplemental Soil Cleanup Objectives.
    d. For sites with no ecological resources (as described in CP-51, Section V.C.) the Supplemental Soil Cleanup Objectives for Ecological Resources shall not apply. The determination regarding whether ecological resources are present shall be made by the Hazmat Consultant of the RIOC.

2. For fill and backfill proposed for use below cover material (as defined in the previous paragraph) and underneath areas with no potential for public contact (e.g., floor slabs and pavement), environmentally clean fill is defined as soil that has been tested utilizing methods which yield laboratory reporting limits that are below the regulatory comparison criteria and found to contain:

    a. No detectable concentrations of volatile organic compounds;
    b. No other organic compounds or inorganic analytes at concentrations above the lower of DER-10 Technical Guidance for Site Investigation and Remediation, Appendix 5, “Allowable Constituent Levels for Imported Fill or Soil” Restricted Residential Use and Ecological Resources Soil Cleanup Objectives; and,
    c. No other organic compounds or inorganic analytes at concentrations above the lower of the NYSDEC CP-51: Soil Cleanup Guidance Residential Use, Protection of Ecological Resources, and Protection of Groundwater Supplemental Soil Cleanup Objectives.
    d. For sites with no ecological resources (as described in CP-51, Section V.C.) the Soil Cleanup Objectives for Ecological Resources shall not apply. The determination regarding whether ecological

resources are present shall be made by the Hazmat Consultant of the RIOC.

1.4 SUBMITTALS

A. Product Data

Provide manufacturer's information on the compaction equipment to be used on each type of material for review.

B. Shop Drawings

Submit shop drawings and associated calculations for sheeting, shoring, and bracing. Shop drawings and calculations shall be signed and sealed by a New York State licensed professional

C. Samples

Provide a 15 pound bag of each material used for fill, backfill, aggregate base, and crushed stone to the RIOC's testing laboratory.

D. Quality Control Submittals

1. Design Data:

Provide the following information:

a. Gradation analysis for fill materials.
b. Gradation analysis for aggregate bases.
c. Gradation analysis for crushed stone.
d. Material composition analysis of recycled concrete material.

2. Certificates

a. Provide certificate guaranteeing fill and backfill material used for construction conforms to the samples supplied and the requirements of this section.
b. Provide certificate guaranteeing aggregate materials used for construction conform to the gradation supplied and the requirements of this section.
c. Provide facility permits, material acceptance requirements, and waste analytical requirements for each proposed off-site disposal facility that conform to the requirements of this section.
d. Provide a certification, along with the testing results indicated below under “Testing”, to the Hazmat Consultant for review and approval from each proposed borrow area stating that the imported fill and aggregate are environmentally clean and each meet the requirements of this section of the specifications and the test data is

representative of the source. The letter shall also provide for each borrow area site: street address; section, block and lot numbers; and, a description of the current and former uses of each borrow area site.

e. Provide a certification at the time of delivery of each load of environmentally clean fill that the load was shipped to the site directly from the RIOC approved source of environmentally clean fill. This certification shall show the name and address of the source of each load, the license plate number of the vehicle transporting the load, and the time of departure of the load from the source.

3. Contractor Qualifications

Provide proof of Contractor and Professional Engineer qualifications specified under “Quality Assurance”.

4. Testing

a. Provide analytical testing of:

1) Existing material to be removed to satisfy requirements of disposal facilities.
2) Borrow (imported fill) material to verify it is environmentally clean fill for use as cover material and for use below cover material or underneath areas with no potential for public contact. Samples shall be collected at a frequency of no less than one sample per 500 cubic yards and shall be analyzed for the full list of 6 NYCRR Part 375 and NYSDEC CP-51 Supplemental Soil Cleanup Objectives Parameters (as defined above) using acceptable laboratory reporting limits (below the regulatory comparison criteria) to demonstrate that the soil complies with the requirements for environmentally clean fill.
3) Existing material to be reused on-site to verify that the material meets the definition of environmentally clean fill for use as cover material and for use below cover material or underneath areas with no potential for public contact. Samples shall be collected at a frequency of no less than one sample per 500 cubic yards and shall be analyzed for 6 NYCRR Part 375 and NYSDEC CP-51 Supplemental Soil Cleanup Objectives Parameters (as defined above) using acceptable laboratory reporting limits (below the regulatory comparison criteria) to demonstrate that the soil complies with the requirements for environmentally clean fill.

b. Analytical testing shall be performed by a New York State Department of Health Environmental Laboratory Approval Program (ELAP) certified laboratory engaged by the Contractor. Laboratory

reporting limits shall be acceptable to the RIOC (i.e., below the regulatory comparison criteria). Utilize “Template 1A or “Template 1B” as directed by the RIOC’s Hazmat Consultant provided at the end of this section. The Contractor shall strictly adhere to the format and content guidance of the Hazmat Consultant template tables.

5. Documentation of Proper Disposal

Documentation acceptable to the RIOC that material removed from the site for disposal has been disposed of at a facility approved by the RIOC.

1.5 QUALITY ASSURANCE

A. Qualifications

1. Company specializing in performing the Work of this Section shall have a minimum of 3 years experience and shall have worked on 3 projects of similar size.

2. Preparation of details of sheeting, shoring, and bracing shall be under the direct supervision of and bear the seal of a Licensed Professional Engineer of the State of New York experienced in the design of such work, who shall also be responsible for filing such documents and the construction supervision of such.

B. Regulatory Requirements

1. Work of this Section shall conform to all requirements of the NYC Building Code and all applicable regulations and guidelines of all governmental authorities having jurisdiction, including, but not limited to, safety, health, and anti-pollution regulations. Where more stringent requirements than those contained in the Building Code or other applicable regulations are given in this Section, the requirements of this Section shall govern.

2. Work outside the street line shall conform to the requirements of the governmental authorities or utilities having jurisdiction (i.e. DOT, DEP, etc.). Where more stringent requirements than those provided by the applicable governmental authority are given in this Section, the requirements of this Section shall govern.

3. Conform to requirements of "Safety and Health Standards, Subpart P - Excavations, Trenching and Shoring" - OSHA.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Imported fill and aggregate materials to be used for project are to be stockpiled separately at the producer's facility and shall be accessible to inspection and quality control (QC) testing by the RIOC.

B. Stockpile material brought to the site prior to placing in order to allow for testing by the RIOC's testing laboratory. Stockpile material in such a manner as to prevent erosion and dust. Provide silt curbs if necessary.

C. Testing and certification of all imported environmentally clean fill and aggregate are the responsibilities of the Contractor.

1.7 PROJECT/SITE CONDITIONS

A. Obtain all Building Department data available on the lot and those adjacent lots affecting or being affected by the project construction.

B. Prior to clearing and removal or abandonment of improvements, ascertain the exact locations of all existing underground utilities. Protect these during subsequent operations.

1. Demolish and remove underground utilities designated to be removed. Coordinate with utility companies for shut-off of services if lines are active.

2. Consult immediately with the utility owner for directions should uncharted or incorrectly charted piping or other utilities be encountered during excavation. Cooperate with the utility owner, the Board of Education, and owners of lots serviced by the utilities in keeping their respective services and facilities in operation. Repair damaged utilities to the satisfaction of the Utility Owner.

3. Do not interrupt existing utilities serving facilities occupied and used by the Board of Education or others during occupied hours, except when permitted in writing by the RIOC and the affected lot owners, and only after acceptable temporary utility service has been provided. Do not proceed with interruption of services without providing a minimum of 48 -hours notice to the affected parties and receiving their written approval.

C. Coordination

Examine drawings to determine sequence of operations, and relation to work of other trades. Start of work will signify acceptance of field conditions and will acknowledge coordination with other trades.

1.8 SEQUENCING AND SCHEDULING

A. Perform work in such a manner to ensure a minimum interference with roads, walks, adjacent properties, and facilities to remain open. Do not close or obstruct these

items without obtaining permits from the agencies having jurisdiction or the permission of the adjacent owners.

B. There shall be no petroleum-contaminated material and/or hazardous waste excavation and handling activities performed when the existing building is in use by the RIOC or others during occupied hours, except when permitted in writing by the RIOC.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Restricted Excavated Material

Remove all debris not explicitly designated to be salvaged (to remain) from improvements and soil excavated during construction from premises and legally dispose of away from premises as part of the base bid. Any environmentally clean fill (as defined in Paragraph 1.04F of this Section and tested to meet such requirement) meeting the gradation requirements of Paragraph B below may be reused on the site pending credit to the RIOC.

B. Fill and Backfill

Only environmentally clean fill (as defined in Paragraph 1.04F of this Section) shall be used as fill and backfill. All fill and backfill shall be material classified as controlled fill by the New York City Building Code. Composition shall consist of a mixture of angular sands and gravels. Flat structured material such as mica (the main component of “mole” rock) falling into the acceptable gradation or other material affecting the permeability and structural characteristics of the sand material shall be no more than .4% of the total material. Material shall not contain salts or foreign materials of any kind and the material shall show a percentage of wear by the Los Angeles wear test (ASTM C131) of not more than 35%. These fill materials shall contain no particles exceeding 3" in the largest dimension. No more than 30% of the material by weight shall be retained on a 3/4” sieve. No more than 10% shall pass the No. 200 sieve by weight. The Contractor shall provide the RIOC with laboratory data on material proposed for use as fill/backfill. Samples shall be collected from imported material and material proposed for reuse on-site. The Contractor shall collect and analyze one representative sample of each material for every 500 cubic yards of imported fill/backfill brought to the site or material proposed for reuse on site for the complete list of 6 NYCRR Part 375 and NYSDEC CP-51 Supplemental Soil Cleanup Objectives Parameters as defined in Paragraph 1.04F.

C. Aggregate Base

1. Aggregate base course, to be used under pavements, driveways, and slabs, shall be composed of crushed ledge rock (blue stone) or talus, roughly cubical or pyramidal in shape, and sand meeting the gradation and soundness requirements of New York State DOT, Item 3.04.02, Type 2.

Material shall be uniform in quality and free of wood, loam, clay, dirt, roots, bark, and any other extraneous material. Material shall not contain salts or foreign materials of any kind. The aggregate shall be produced from material showing a percentage of wear by the Los Angeles wear test (ASTM C131) of not more than 35%.

2. Stone shall have the following gradation:

Sieve	Percent Passing by Weight
2"	100
1/4"	25-60
No. 40	5-40
No. 200	0-10

D. Crushed Stone

1. Crushed stone, to be used under interior slabs on grade and backfill at narrow excavations, shall be composed of crushed ledge rock (blue stone) or talus, roughly cubical or pyramidal in shape, with a gradation conforming to ASTM C33 No. 57 stone. Material shall be uniform in quality and free of wood, loam, clay, dirt, roots, bark, and any other extraneous material. Material shall not contain salts or foreign materials of any kind. The aggregate shall be produced from material showing a percentage of wear by the Los Angeles wear test (ASTM C131) of not more than 35%.

2. Stone shall have the following gradation:

Sieve	Percent Passing by Weight
$1^1/_2$"	100
1"	95-100
1/2"	25-60
No. 4	0-15
No. 8	0-5

E. Recycled Concrete Aggregate

1. As an option, recycled concrete aggregate may be used instead of ledge rock for aggregate base, crushed stone, and broken stone ballast (meeting the indicated gradations for each), depending on the soundness of aggregates, which are at the Engineer of Record's option. The material must be clean, with no deleterious material visible (wood, brick, metal, or other friable material) and meet the following criteria:

   a. Material shall consist of at least 99% by weight of Portland cement concrete or ledge rock.

b. Material making up the remaining 1% shall be as follows:

1) Wood - 0.1% maximum
2) Brick, mica schist, metal, or other friable stone material - 0.4% maximum
3) Asphaltic Concrete - 1% maximum

c. Material shall be environmentally clean (as defined in Article 1.04F of this Section).

2.2 EQUIPMENT

A. Provide proper compaction equipment to properly compact subgrade, fill and backfill, aggregate base, crushed stone and broken stone base. Subgrade compaction requirements are indicated in those sections. Employ a Licensed Professional Engineer to determine soil type and which equipment will give the proper compaction.

2.3 SOURCE QUALITY CONTROL

A. Tests

The RIOC's Testing Laboratory will perform the following laboratory tests:

1. Sieve Analysis: Performed in accordance with ASTM D422 on submitted fill samples to verify material meets gradation requirements.

2. Moisture Density Curve: Optimum moisture content obtained from submitted fill samples, tested in accordance with ASTM D1557.

B. Inspection

1. Testing Laboratory

a. The RIOC will engage an approved Testing Laboratory or Special Inspection Agency to perform laboratory tests and field compaction testing on the fill/backfill materials and subgrade.
b. The Laboratory will be responsible to and under the supervision of a Special Inspector.

2. Special Inspection

The RIOC will assign, under the requirements as defined in Chapter 1 Title 28 of the NYC Administrative Code and Section BC 1704.7 of the 2014 NYC Building Code, a Special Inspector to supervise the testing of the controlled filling operations and approval of the subgrade bearing capacity, as well as and inspection of shoring operations as per Section BC 1704.20.2.

3. Contractor's Responsibility

Inspections and testing performed by the RIOC's agent(s) shall not relieve the Contractor of responsibility for performing all other testing and inspection specified herein or otherwise necessary to meet the quality control and quality assurance requirements of this Section.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verification of Conditions

Verify existing site conditions match those of the Drawings and pre-bid inspections. Notify the RIOC in writing prior to commencement of Work of any discrepancies.

B. Preparation

1. Before starting any excavation work for new construction, ascertain the exact locations of all existing underground drain lines, piping, and conduits. Consult with the Mechanical Trades.

2. At location where any of the above services interfere with the excavation work, notify the RIOC and Mechanical Trade under whose jurisdiction such work falls before continuing with any more excavation.

3.2 PREPARATION AND PROTECTION

A. General

1. Provide adequate protection measures to protect workmen and pedestrians at the site.

2. Prevent damage to existing improvements designated to remain. If they are damaged during construction, restore improvements to their original condition.

3. Prevent damage to improvements on adjoining properties. Restore damaged improvements to their original condition to the satisfaction of their owner. Restore grades and vegetation to their original condition or better.

4. Hire a qualified horticulturist or arborist to supervise the protection of and the repair or replacement of damaged trees or other vegetation, including those of adjacent properties. Vegetation damaged during construction shall be replaced with same size and type.

5. Salvable Improvements

   a. Carefully remove and protect all items to be saved and reused. Replace any items which are damaged by removal at own cost.
   b. Notify the RIOC in writing of any item which is damaged prior to removal so that they may ascertain the item's condition.

B. Condition Survey

1. General: The Contractor shall perform a condition survey of the adjoining properties and existing school building prior to beginning excavation. Note damage to existing structures.

2. Photographs: Take photographs of the building walls of the adjoining properties and existing school so that the surfaces may be examined during construction and compared with the pre-work condition. If any cracks or other stress signs are exhibited by the buildings, halt operations until corrective action has been provided and is acceptable to the RIOC. Take photographs of existing vegetation to record condition, size, and type.

C. Shoring, Sheeting, and Bracing

1. General

   a. Inspect site, examine existing conditions and make all necessary preparations for the safe and proper sequence of work.
   b. Properly guard and protect excavations so as to prevent them from becoming dangerous to person or property.
   c. Properly slope sides of excavation or provide shoring, sheeting and bracing to prevent caving, erosion, or gullying of sides of excavations. The sides of all excavations that are 5 feet or greater in depth measured from adjacent ground surface to the deepest point, shall be protected to prevent the sides from caving in. Alternatively, excavation sides may be sloped not steeper than 45 degrees.
   d. Brace, shore, and protect existing structures when excavations are made adjacent to the existing structures or within a distance that they will be affected by the excavation.
   e. Maintain sides and slope of excavation in safe condition until backfilling or other work is complete. Maintain shoring and bracing in place till completion of work. Ensure that after all rainstorms all sides or slopes of excavations are inspected as per Section BC 3304.5.1 and safe conditions restored.
   f. Provide materials for work in good serviceable order.
   g. All shoring, bracing, sheet piling, etc. is to be removed upon completion of the work where they are installed, including any portion thereof, outside of street and lot lines. Within the lot, remove all wood and cut steel elements at a minimum to 4 feet below grade.

Where they interfere with new work and utilities, remove elements in their entirety.

2. Inspection and Code Requirements

a. Sheeting, shoring, and bracing for protection of excavations and protection of adjacent structures and the public is the responsibility of the Contractor and shall comply with the requirements of Section BC 3309, Protection of Adjoining Property.
b. The most stringent requirements of the Building Code, Contract Drawings, Specifications, or any authorities having jurisdiction shall govern this Work.
c. Coordinate Work of this Section with Work of all other Divisions so as to properly, and completely, install all Work as drawn or specified.
d. The Contractor shall engage the services of a third party Registered Professional Engineer (not a direct employee) to prepare details of bracing, sheeting, shoring, party wall stabilization, and other construction required for protection of excavations and support of adjacent properties or buildings as per Sections BC 1704.20.7, BC 3309.6 and BC 3309.4.4. These drawings shall be submitted to the Engineer of Record for general review, which does not relieve the Contractor's Engineer of responsibility for the adequacy of the design.
e. The Contractor's Engineer shall file Form PW-1 with the Building Department, thereby becoming the Engineer of Record for such protection work and is responsible for stability of all slopes and bracing and for preparation of all design and shop drawings and their approval by the Building Department prior to obtaining a permit. The SCA will engage a Special Inspection Agency to perform the Special Inspections described in Sections BC 1704.20.2 and BC 3304.4.1.
f. As per Section BC 3304.3.1, no earthwork within the property line shall commence unless Contractor or permit holder notifies the Department of Building via phone or electronically within 24 to 48 hours prior to the commencement of such work. The Contractor shall preserve and protect from damage any adjoining structures.
g. When an excavation to a depth of 5 to 10 feet is to be made within 10 feet of an adjacent building or over 10 feet anywhere on the site, the Contractor shall provide written notice to the owner of the adjacent building not less than 10 days prior to the starting of excavation as per Section BC 3304.3.2. The written notice shall describe the work, timeframe and schedule and contact information of the contractor and of the department. No excavation shall commence until the Contractor has documented the existing conditions of all adjacent buildings in a pre-construction survey.

D. Water Control - Dewatering

1. Provide for the pumping and removal of all water that is encountered on the Site at any location, at any and all times, during the course of construction of the project and until the acceptance of the Work.

2. Prevent surface water from flowing into excavations and from flooding the project site and surrounding area in order to keep the site and foundation subgrades dry.

3. Provide and maintain pumps and other dewatering system components necessary to convey water out of excavations and demolitions, as well as removing away all surface water. Remove all water from the area of Work.

4. The Contractor shall utilize methods that minimize drawdown and pumping rates, and comply with dewatering permit.

5. The Contractor shall be responsible for all remedial action due to problems arising from improper/illegal dewatering. The Contractor shall obtain all permits from governing regulatory agencies, including but not limited to New York City Department of Environmental Protection (DEP) and New York State Department of Environmental Conservation (DEC), for dewatering and the off-site disposal of water.

6. Dispose of water from site in such manner as will not cause injury to the public health, nor to public or private property, nor to the work completed or in progress, nor to the surface of the streets, nor cause any interference with the use of the same by the public. Contaminated water generated from dewatering activities shall not be disposed of on site. At a minimum, a fractionation tank, oil/water separator, and granular activated carbon adsorption system shall be provided for treatment of contaminated water. Prevent silting of storm sewers by using settling tanks or other devices approved by the DEP. Clean sewer lines that are to be used for disposal of water and waste during construction. The Contractor is responsible for obtaining all necessary permits for disposal of liquids generated during dewatering operations and for the pretreatment of all liquids as required for disposal in accordance with all applicable rules and regulations.

7. Place all dewatering and discharge pipes and hoses that cross traveled roadways in such a manner so as to eliminate any disruption of traffic flow. If so ordered by the RIOC, place the pipe and hoses in shallow trenches that will then be plated over. Firmly secure all plates so as to eliminate any possible shift or movement.

E. Frost Protection

1. Furnish all facilities and materials needed to prevent the earth and/or rock at bottom of excavation from becoming frozen or unsuitable to receive footings, etc.

2. When excavations for footings, etc. have been brought to the bottom elevations indicated on the Drawings and the bottoms of these excavations become frozen or otherwise unsuitable in the opinion of the Special Inspector because of inadequate protection by the Contractor, these excavations shall be carried to lower depths sufficient to provide stable bearings as determined by the Special Inspector and subject to approval by the Engineer of Record and without additional cost to the RIOC.

F. Use of Explosives

The use of explosives is prohibited.

G. Workability of Excavation Subgrade

1. Take all steps necessary to prepare or improve existing conditions for proposed foundation work, including general excavation throughout the project site.

2. Properly grade site and perform operations to avoid disturbing the existing subgrade and any intermediate subgrade.

3. If subgrade conditions are disturbed that prevent earthwork operations or safe operation of foundation installation equipment, the Contractor shall take steps to improve subgrade conditions at own expense. Many types of soils are sensitive to disturbances such at water saturation or construction traffic and become unworkable.

3.3 EXCAVATION - GENERAL

A. Excavate all earth, rock, and materials of every kind to the Contract elevations and dimensions required by the Drawings and Specifications and any additional required for safe slope of excavation, regardless of the character of materials and obstructions encountered. Prior to excavation, perform GPR survey of area of excavation to determine location of any unknown buried utilities.

B. Remove trees, vegetation, and improvements designated on the Drawings to be removed. Remove abandoned improvements and those found during construction in part or whole that interfere with construction.

C. No additional compensation will be allowed for excavation or foundation work carried below the levels shown on Drawings unless same has been authorized in writing by the RIOC. Contractor is responsible for all remedial work due to unauthorized excavation.

D. Level off and grade bottoms of excavations to receive footings, slabs, pavements, etc.

E. For footings and foundations, machine excavation is allowed to within one foot of final subgrade. Excavate balance by hand. Excavate to a tolerance of plus or minus 0.10' and extend a sufficient distance from the structures to permit placing and removal of formwork, installation of services, other construction, and for inspection.

F. For pavements and slabs on grade, excavate to depths required for installation of aggregate base or pavement as specified herein or shown on Drawings.

G. All excavations for foundations and footings must be completed and the underlying soil or rock material approved by the Special Inspector before concrete foundation work is started. The Contractor may, with the written approval of the RIOC, proceed with concrete foundation work before the entire building excavation has been completed. In addition, excavation for foundations and footings shall conform to Section BC 3304 unless more severe requirements are given in this Section.

H. Remove all excavated material from the site and legally dispose of away from the premises, in accordance with the requirements specified in this section. Burning of material on the site is not permitted.

I. Trenching for pipes and conduits is described under "Excavation of Trenches."

J. Exposed Ground Surfaces/Landscaped Areas:

1. At seeded, sodded, or ground cover areas, excavate to 24" below finished grade. If rock occurs within 18" of finished grade, all rock shall be removed to a depth of 18". Where existing stone, concrete, brick, or other masonry occurs at these areas, such material shall be excavated and removed to a minimum depth of 24" from finished grade.

2. In garden areas or where shrubbery/trees are required, including tree pits, excavate to 24" below finished grade, but if rock occurs within 36" of finished grade, all rock to a depth of 36" shall be removed. Where existing stone, concrete, brick, or other masonry occurs at these areas, such material shall be excavated and removed to a minimum depth of 24" from finished grade.

3. For additional excavation requirements of tree pits below the general excavation levels called for under this Article, refer to Section 02900.

3.4 EXCAVATION - ROCK

A. Excavate rock where encountered by means other than blasting.

3.5 EXCAVATION OF TRENCHES

A. Trenching shall be accomplished with an appropriate trenching machine, except hand trenching shall be used where machine may damage existing underground pipe, conduit, or other objects to remain.

B. Excavate trenches to elevations required to install pipes and conduits at required inverts, as required by governing regulatory agencies, as shown on Drawings, as specified herein, and to allow encasement in concrete when indicated on Drawings. All items shall have full bearing when placed.

C. Remove loose material and proofroll trench subgrade with a vibratory plate or jumping compactor (a minimum of 6 passes, 3 in each direction, if material is fill) in the presence of the Special Inspector. Remove any soft spots and replace with controlled fill, compacting material in 4" lifts to 92% (95% in vehicular areas) of maximum dry density by ASTM D1557 at optimum moisture content.

D. Excavate trenches of sufficient width to allow for proper installation of the require item.

E. Prevent trench bottoms from freezing until items are placed and the trench backfilled.

F. Fill trench with concrete to a depth even with the bottom of footings when excavations pass within 18" of the footings at a depth below the footing. Continue concrete 2'-0" each side of the footing.

G. Work outside the street line in governed by the regulatory authority having jurisdiction for such.

H. Trenches shall be dry when trench bottom is prepared and, where applicable, when bedding concrete is placed.

I. At water pipe, line trenches with non-woven geotextile filter fabric immediately before pipe laying to prevent soil contamination in the pipe.

3.6 DISPOSAL OF EXCAVATED MATERIAL

A. Description of Work

1. Deliver material excavated from the site to an approved off-site disposal facility identified in the Excavated Material Disposal Plan. The Excavated Material Disposal Plan must be prepared in accordance with Paragraph B utilizing Template 2 of this Section and must be submitted and approved by the RIOC's Hazmat Consultant prior to the start of excavation. No claims of delay shall be permitted due to the Contractor's failure to obtain approval of the Excavated Material Disposal Plan from the Hazmat Consultant. All required sampling and testing are part of the Work and are to be done by the Contractor as part of this project at no additional cost to the RIOC. The resulting sampling data is to be submitted to the RIOC as an addendum to the Excavated Material Disposal Plan.

2. Non-Hazardous Excavated Material, as defined in Paragraph 1.04C, that has been excavated as part of the construction project, shall be transported

to an off-site disposal facility meeting the requirements of 6 NYCRR Part 360 or equivalent out-of-state facility approved by the appropriate regulatory agency of that State with a permit to receive non-hazardous excavated material. All petroleum-contaminated material, as defined in Paragraph 1.04D, if discovered, shall be transported to an off-site disposal facility permitted to receive petroleum-contaminated material from known source areas. All hazardous waste, as defined in Paragraph 1.04E, if discovered, shall be transported to an off-site disposal facility meeting the requirements of 40 CFR Part 265 and 6 NYCRR Part 373 or equivalent out-of-state facility approved by the appropriate regulatory agency of that State with a permit to receive hazardous waste. All material excavated from the site is assumed to meet the definition of non-hazardous excavated material as defined in Paragraph 1.04C. If any petroleum-contaminated material or hazardous waste, as defined in Paragraphs 1.04D. and E., is found during the excavation, notify the RIOC for directions on disposal.

B. Excavated Material Disposal Plan

An Excavated Material Disposal Plan shall be prepared by the Contractor and approved by RIOC for non-hazardous excavated material at a minimum of four weeks prior to the start of excavation. A separate Excavated Material Disposal Plan for any additional categories of material, as defined in Paragraphs 1.04D and E, encountered during the excavation, shall be prepared by the Contractor and approved by RIOC prior to removing the material off-site. The Excavated Material Disposal Plan shall be prepared and signed by a Certified Hazardous Materials Manager approved by the Institute of Hazardous Materials Management in Rockville, Maryland, or Qualified Environmental Professional, approved by the Institute of Professional Environmental Practice, Pittsburgh, Pennsylvania, or similar board-certified professions. In the Excavated Material Disposal Plan, the Contractor shall, at a minimum:

1. Indicate how buried utilities (e.g. electric, gas, water, sewers, telephone, etc.) will be located and provide copies of the resulting information to the RIOC.

2. Confirm appropriate contact will be made with underground facilities protective organizations –in accordance with applicable laws and regulations.

3. Provide a to-scale figure indicating the quantities of excavated material and proposed locations where discrete soil samples shall be collected and which discrete soil samples shall make up each composite sample.

4. Define the acceptance and waste characterization requirements of each proposed disposal facility and define the sampling rates (e.g., one composite sample / 500 cubic yards) along with the estimated quantity of material to be disposed for each proposed disposal facility.

5. Define the sampling methods (e.g. backhoe, Geoprobe®, drill rig, etc.) to be used.

6. Define the analytical parameters and analytical methods for analyzing all samples.

7. Define how chain-of-custody will be maintained and recorded.

8. Define how the QA/QC of the Excavated Material Disposal Plan will be maintained and how it will be subject to audit by both the RIOC and the Contractor.

9. Provide a listing, including company name, name of owner, and address of facility, of the off-site disposal facility(ies) meeting the requirements listed in Item A above, for the specific material to be disposed and a copy of each facility's permit (NYSDEC and/or equivalent out of state) and a complete listing of the facility's pre-acceptance testing and disposal requirements for the specific material.

10. Health and Safety Plan for handling the material to be excavated.

11. Provide a listing, including company name and address, of proposed waste haulers. Provide for each proposed waste hauler a copy of the valid 6 NYCRR 364 Waste Transporter Permit. Contractor shall furnish a list approved by the RIOC that identifies the make, model, truck number and registration plate number of each of the trucks that shall transport the material to the designated facility(ies). All proposed destination facilities, listed as required by 9 above, shall be listed in the waste transporter permits provided.

12. If applicable, provide a completed waste profile form for the proposed facility(ies) along with a cover letter on Contractor letterhead certifying that the Contractor has provided the disposal facility with the analytical data. Contractor must verify in writing that full disclosure of soil characterization has been provided to the disposal facility.

C. Material Suitability and Construction Methods:

1. All material excavated from the site shall be transported by the Contractor to an approved off-site designated facility. Environmentally clean material meeting controlled fill gradation may be reused pending credit to the RIOC. When the RIOC orders the Contractor to excavate during other than normal construction hours, the material shall be stockpiled on the site until the material can be delivered to the facility identified in the approved Excavated Material Disposal Plan. Stockpiled excavated soil shall be covered with heavy duty tarps, secured with sand bags. If there is no room on the site for stockpiling, provide containers for stockpiling or other means.

2. Provide all labor, equipment and material necessary to excavate, stockpile, load, handle, and transport excavated material from the site to the facility(ies) designated in the approved Excavated Material Disposal Plan, as described herein, and conditioned on the following:

   a. Comply with all rules and regulations of the body governing the facility(ies) listed in the approved Excavated Material Disposal Plan.

   b. Any sorting of the excavated material required by the designated facility(ies) is part of the Work and is the responsibility of the Contractor.

   c. Prior to commencing off-site disposal, the Contractor shall furnish a list approved by the RIOC that identifies the make, model, truck number and registration plate number of each of the trucks that shall transport the material to the designated facility(ies) defined in the Excavated Material Disposal Plan. Any change of trucks, or additional trucks, shall have prior approval at least 24 hours in advance. The Contractor shall also furnish a list, approved by the RIOC, of the water-level volume of each truck, regardless of whether or not the truck possesses a DOT truck permit number indicating truck volume.

   d. The Contractor agrees and warrants that each load of such material has originated only from the Project Site described in this Project and has not been mixed with material from any other site.

   e. On a daily basis the Contractor shall provide originals of all dump tickets to the RIOC.

D. Excavated Material

1. The excavated material may consist of one or more of the following: non-hazardous excavated material, petroleum-contaminated material and/or hazardous wastes. For the purpose of the base bid, the Contractor shall assume that all material excavated from the site meets the definition of non-hazardous excavated material, and will exceed 6 NYCRR 375-6 Unrestricted Use and Restricted Use Soil Cleanup Objectives and NYSDEC CP-51: Soil Cleanup Guidance Supplemental Soil Cleanup Objectives.

2. All excavated material from the site shall be disposed of in one of the following manners.

   a. In accordance with the approved Excavated Material Disposal Plan developed for this specific material, the Contractor shall transport and dispose of all non-hazardous excavated material at an approved permitted off-site disposal facility meeting the requirements of 6 NYCRR Part 360 or equivalent out-of-state requirements. If material

is temporarily stockpiled on-site, the stockpile shall be covered and silt curbs shall be installed around the stockpile.

b. If required and directed by the RIOC, the Contractor shall stockpile or stage petroleum-contaminated material, as defined in 1.04D, at the site pending sample analysis and off-site disposal. The stockpile shall be covered and silt curbs shall be installed around the stockpile. The Contractor shall negotiate with an approved off-site disposal facility licensed to receive petroleum-contaminated material. The Contractor shall provide the RIOC with a copy of the off-site disposal facility's permit to receive petroleum-contaminated material as part of the separate Excavated Material Disposal Plan. Prior to disposal of this material, the Contractor shall obtain written authorization from the RIOC. In addition the Contractor shall provide the RIOC with original copies of all shipping papers including manifests, weigh tickets, and original invoices for the disposal of this material. The Contractor shall comply with all applicable federal, state, and local rules and regulations pertaining to the handling, management, loading, transportation, and disposal of petroleum-contaminated material.

c. If required and directed by the RIOC, the Contractor shall stockpile or stage hazardous waste, as defined in Paragraph 1.04E at the site pending sample analysis and off-site disposal. The stockpile shall be covered and silt curbs shall be installed around the stockpile. The Contractor shall provide the RIOC with a copy of the off-site disposal facility's permit to receive hazardous waste as part of the separate Excavated Material Disposal Plan. Prior to disposal of this material, the Contractor shall obtain written authorization from the RIOC. In addition the Contractor shall provide the RIOC with original copies of all shipping papers including manifests, weigh tickets, and original invoices for the disposal of this material. The Contractor shall negotiate with an approved off-site disposal facility meeting the requirements of 40 CFR 265 and licensed to receive hazardous wastes. The Contractor shall comply with all applicable federal, state, and local rules and regulations pertaining to the handling, management, loading, transportation, and disposal of hazardous waste.

3. The Contractor shall provide all labor, equipment and material necessary to excavate, load, handle, and transport excavated material, as described herein, from the site to the designated facility(ies), and in accordance with the following:

a. The Contractor shall comply with all applicable federal, state, and local rules and regulations pertaining to the disposal of non-hazardous excavated material, and, if applicable, petroleum-contaminated material, and hazardous waste.

b. The Contractor shall use and identify, in the Excavated Material Disposal Plan, only properly licensed and insured off-site disposal facilities that can accept non-hazardous excavated material, and, if applicable, petroleum-contaminated material and/or hazardous waste.

c. Prior to commencing off-site disposal, the Contractor shall furnish a list approved by the RIOC that identifies the make, model, truck number and registration plate number of each of the trucks that shall transport the material to the designated facility(ies) defined in the Excavated Material Disposal Plan. Any change of trucks, or additional trucks, shall have prior approval at least 24 hours in advance. The Contractor shall also furnish a list, approved by the RIOC, of the water-level volume of each truck, regardless of whether or not the truck possesses a DOT truck permit number indicating truck volume.

4. The Contractor is responsible for implementing all appropriate dust and/or odor control measures, including, but not limited to, water suppression.

5. Prior to departure from the site, transport vehicles shipping excavated material shall be inspected and cleaned to prevent tracking material off-site. Contractor shall properly collect and properly dispose, at an RIOC-approved facility, all waste generated from cleaning.

6. The Contractor shall provide all required notifications to federal, state and local agencies prior to transporting material off site. Copies of all notifications issued shall be transmitted to the RIOC at the time of issuance.

7. The Contractor shall screen drivers of transport vehicles prior to engagement and prior to departure from the site. Vehicle drivers shall be fully-licensed and possess appropriate training.

8. Vehicles used to transport excavated material shall be designed, equipped, operated and maintained to prevent leakage, spillage and airborne emissions during transport. Only safe, suitable and well-maintained vehicles, which are properly labeled/placarded, manned, permitted and registered to perform the required transportation services, shall be used.

E. Payment

1. All labor, materials, equipment, and incidentals to perform all work under this Section shall be included in the base bid. No separate payment will be made for any Work associated with the disposal of non-hazardous excavated material, as the cost of said work shall be deemed included in the Contract.

2. Reimbursement of payment for transport and disposal of any petroleum-contaminated material and hazardous waste encountered, and approved by the RIOC, shall be reimbursed at negotiated unit rates, exclusive of quantities already provided for elsewhere in the documents that shall be included in the base bid.

3. Payment for the transportation and disposal of petroleum-contaminated material and hazardous waste encountered not part of the base bid shall be contingent upon the RIOC's receipt of original shipping documents (e.g., manifests), weigh tickets, and original invoices. No additional payment will be made for excavating/removing and loading and other requirements of this Section for these materials because it is covered under the base bid.

4. The Contractor shall credit the RIOC for any quantities of excavated material that the RIOC approves for reuse on-site.

3.7 FILLING AND GRADING

A. General

1. Do not commence filling and backfilling operations until proposed fill and backfill have been approved by the Hazmat Consultant (in addition to gradation approvals), construction below finish grade has been approved, underground utilities and mechanical items inspected and tested, forms removed, waterproofing/membranes/coatings and other improvements installed, trash and debris removed, and temporary and permanent bracing installed.

2. Do not commence backfilling, filling and grading until existing subgrades have been compacted.

3. Backfilling of trenches is described under "Backfilling of Trenches".

4. Fill all excavations, backfill against all walls, and do all filling and grading necessary to bring the surfaces to the level required.

5. Do not backfill against concrete elements until the concrete has obtained its specified compressive strength.

6. Take particular care when rolling over areas where trenches or other excavations have been made and backfilled.

7. Fill voids caused by the removal of below grade improvements.

8. Grade bottoms of pavements toward sediment pits or catch basins to maintain uniform thickness of the slabs.

9. A minimum of 24" of environmentally clean fill (as defined in Paragraph 1.04F) that has been tested utilizing laboratory reporting limits which are acceptable to the RIOC (i.e., below the regulatory comparison criteria) shall be used on all exposed ground surfaces, including landscaped areas (grass, sod, groundcover, shrub areas, tree areas, including tree pits, etc.). Provide environmentally clean fill to bring soil to depth below the required amount of top soil required for each type of planting as described in Section 02900.

B. Compaction of existing subgrade

1. Surface Preparation: Existing subgrade shall be free from stumps, bushes, roots, sod, topsoil, rubbish, garbage, and any other material that may decay.

2. Grading

a. Prior to placing fill or backfill in any area, grading is to be performed as required to provide for drainage. Ditching or filling around the area shall be performed to intercept or divert all surface water.
b. On completion of grading as specified above, closely examine to determine whether excessive wetness, springs, or other seepage of water can be observed at any point. If such conditions exist, positive drainage in suitable form, such as french drains or tilling, must be provided before placement of fill is undertaken.
c. When the fill area has been prepared as specified above, compact the natural ground surface by methods indicated in 3 below.

3. Method of Compaction

a. Natural undisturbed material shall be graded and compacted to attain a uniform surface. These areas shall be determined by the Special Inspector.
b. Existing subgrade shall be proofrolled in the presence of the Special Inspector for the following conditions:

1) Subgrade consists of uncontrolled fills.
2) Identification of shallow loose zones of material or identification of soft/spongy material at surface.

c. Proofrolling shall be accomplished with a minimum of four passes using a compactor of minimum static weight of 19,000 lbs, a minimum dynamic force of 40,000 lbs, and a total applied force of not less than 7,500 per foot of drum width. In areas inaccessible to the heavy equipment, provide a minimum of six passes with a vibratory plate or jumping compactor. Fill shall not be placed until the subgrade is approved by the Special Inspector.

4. Soft Areas During Compaction: If any areas show pumping, noticeable weaving, or which are otherwise unsatisfactory, undercut material within the

limits and extent ordered by the Special Inspector. These areas shall be replaced with controlled fill, compacted to 92% of maximum dry density by ASTM D1557 at optimum moisture content (95% for vehicular areas), unless otherwise directed by the Engineer of Record.

C. Placement and Compaction of Fill and Backfill

1. Placement

a. General: Begin fill and backfilling in the lowest section of the area. Spread material evenly by mechanical equipment or by manual means above the approved compacted subgrade in lifts not exceeding 6" to 8". Build layers as horizontally as practical to prevent thickness of lift from exceeding that specified but provide with sufficient longitudinal and transverse slope to provide for runoff of surface water from every point.

b. Moisture Control: The moisture-density curve for the fill use shall be supplied to the Contractor as a guide in controlling moisture to achieve the required degree of compaction. If, in the opinion of the Special Inspector, fill material becomes too wet for the required compaction, the fill shall be dried by a method approved by the Special Inspector prior to commencing or continuing compaction operations. Likewise, if, in the opinion of the Special Inspector, the fill material becomes too dry for the required compaction, the fill shall be moistened by a method approved by the Special Inspector prior to commencing or continuing compaction operations.

2. Compaction: Compact each lift to the degree of compaction indicated below. The degree of compaction shall be checked by the Special Inspector and each successive lift shall not be placed or compacted until the previous lift is inspected and approved by the Special Inspector. Compact the fill and backfill to elevations and limits shown on Drawings and is subject to final inspection and approval by the Special Inspector. Extend the compacted fill beyond the berm lines on a slope downward at a maximum slope of two horizontal to one vertical to intersect the approved stripped subgrade. Maintain the fill slopes at all times.

a. Areas to receive heavy vehicular traffic or footings: 95% of the maximum dry laboratory density by D1557 at optimum moisture content.
b. All other areas: 92% of the maximum dry laboratory density by D1557.

3. Drainage During Fill Operation: At all times, maintain and operate proper and adequate surface and subsurface drainage to the satisfaction of the Special Inspector in order to keep the construction site dry and in such condition that placement and compaction of fill may proceed unhindered by

saturation of the area. Submit method of dewatering to the RIOC for prior approval. Such approval shall not relieve the Contractor of his responsibility to maintain the site dry during the compaction operation. See Article 3.02.

4. Frost: Do not place fill materials when either the fill materials or the previous lift (or subgrade) on which it is placed is frozen. In the event that any fill which has already been placed on the surface shall become frozen, it shall be scarified and recompacted, or removed, to the approval of the Special Inspector before the next lift is placed. Remove or recompact any soft spots resulting from frost to the satisfaction of the Special Inspector before new fill is placed.

D. Placement and Compaction of Aggregate Bases and Crushed Stone

1. Provide aggregate base under all exterior pavements and wherever else indicated on the Drawings or specified herein. Provide crushed stone under all interior slabs. Provide 6" minimum unless specified otherwise elsewhere.

2. Verify finished subgrade is at proper level.

3. Prior to placement of material, reroll subgrade with a two-ton roller or hand tamper.

4. Place aggregate base and crushed stone in layers of uniform thickness, but not exceeding 6". Compact material to either 80% of relative density or 92% (95% for heavy vehicular traffic) of maximum dry density at optimum moisture in accordance with ASTM D1557. Maintain optimum moisture content for compacting the material. Place material in single layer for aggregate courses 6” or less. Alternate blading and rolling to obtain a smooth, even, and uniformly compacted course.

3.8 BACKFILLING OF TRENCHES

A. Do not backfill trenches until tests and inspections have been made and the backfilling authorized by the RIOC. Use care to avoid damage or displacement of pipe or conduit.

B. Backfill with controlled fill and compact each layer to 92% (95% for vehicular areas) of its maximum density as per ASTM D1557 using a vibratory plates, jumping compactors, or other approved means.

3.9 FIELD QUALITY CONTROL

A. Tests

1. Sieve Analysis: The RIOC's Laboratory will perform sieve analysis in accordance with ASTM D422 on fill and aggregate materials at the site prior to placement in order to verify conformance with the submitted samples.

The laboratory will take one sample at a minimum for every 100 CY placed (or portion thereof) each day. If material appears to vary from approved material, more frequent testing will be done and if results indicate material varies from that approved, costs of such testing will paid by the Contractor.

2. Field density tests: The RIOC's Laboratory will perform in-place field density tests in accordance with either of the three following procedures; ASTM D1556, ASTM D2167, or ASTM D2922.

   a. Existing subgrade. One field density test for each 2000 ft^2, but in no case less than three tests.
   b. Fill areas - For each lift, one field density test for each 2000 ft^2, but in no case less than three tests.
   c. Backfill areas - For each area, two field density tests per lift at locations determined by Special Inspector and one test per lift for every 50 linear feet of trench.

3. Environmentally Clean Fill/Backfill Tests

   a. The RIOC, as a quality assurance measure, may perform applicable analysis of fill/backfill material samples to verify that the material meets the environmentally clean fill requirements.
   b. The Contractor shall notify the Hazmat Consultant of the RIOC a minimum of two business days prior to collection for environmental testing of each sample of environmentally clean fill, and, if requested by the RIOC, shall arrange for a representative of the Hazmat Consultant to observe collection of each sample.
   c. The RIOC will require that the Contractor provide the certifications required by this specification at the time of delivery of each and every load of environmentally clean fill showing that the load was shipped to the site directly from the approved source of environmentally clean fill.
   d. The Contractor shall be required when requested by the RIOC to arrange for access for a representative of the RIOC to observe the loading of trucks at the source of environmentally clean fill.

B. Inspection

1. Fill and Backfill Compaction: The Special Inspector will give approval for each lift in accordance with Sections BC 1704.7.2 and BC 1704.7.3. In the event that the compaction requirements are not satisfied, the lift shall be rerolled or removed and again tested until the required compaction is obtained.

2. Footing Subgrade: The Special Inspector is responsible for approval of bearing capacity for all footings in accordance with Section BC 1704.7.1.

3. Excavation - Sheeting, Shoring, and Bracing: The Special Inspector is responsible for inspection of underpinning in accordance with Sections BC 1704.20.2 and BC 3304.4.1. Contractor's licensed professional engineer is to file all design documents as specified in Article 3.02 of this Section.

4. Contractor's Responsibility: The Contractor shall notify the RIOC at least 48 hours prior to filling operations, pouring of footings, and installation of excavation support to allow for the RIOC to have the appropriate personnel at the site.

5. Contractor's Inspections: Inspections and testing performed by the RIOC shall not relieve the Contractor of responsibility for performing all other testing and inspection specified herein or otherwise necessary to meet the quality control and quality assurance requirements of this Section.

C. Responsibility

1. All required testing and/or analysis not specifically defined as being provided by the RIOC shall be provided by the Contractor as part of the included Work and costs of this Project.

2. No testing and/or analysis by the RIOC shall relieve the Contractor of the responsibility of conforming to the requirements of these specifications.

3. Time for conducting the tests and/or inspections defined in these specifications shall be considered as part of the Work of this Project and neither extension of time nor additional costs shall be accepted as a result.

3.10 PROTECTION

A. Protect graded and compacted areas from traffic and erosion. Keep free of trash and debris.

B. When completed compacted areas are disturbed by subsequent construction or weather, scarify surface, re-shape, and compact to required density prior to further construction.

C. Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

D. A guardrail or solid enclosure at least 3'-6" high shall be provided along the open sides of excavations, except if the side slopes are one vertical to three horizontal or flatter.

END OF SECTION 022010

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SECTION 024119 - SELECTIVE REMOVALS & DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of Work

Removal and demolition of selected items from selected areas of the building as indicated on the Drawings; items to be removed include, but are not limited to, the following:

1. Removal of pavers.

2. Removal of planter curb and fence.

B. Recycling and disposal of non-hazardous waste, if any, shall be performed in accordance with Construction Waste Management.

1.2 SUBMITTALS

A. Shop Drawings

For that part of the Work that is not considered minor alterations or ordinary repairs, submit shop drawings and associated calculations. Demolition drawings and sequencing shall be signed and sealed by a Professional Engineer licensed in the State of New York and Design Drawings of such shall be filed with the Building Department.

B. Schedule

Submit a schedule indicating proposed methods and sequence of operations for selective removals and demolition Work, prior to commencement of operations. The sequence of operations shall be planned, in detail, to ensure uninterrupted progress of school sessions.

C. Submit details and procedures for dust and noise control.

D. Quality Control Submittals

1. Contractor Qualifications

a. Provide proof of Contractor and Professional Engineer qualifications specified under “Quality Assurance”.
b. Provide proof of Refrigerant Recovery Technician qualifications

1.3 RESPONSIBILITY, PROTECTION, DAMAGES, RESTRICTIONS

A. Condition of Space

The RIOC assumes no responsibility for actual condition of the space in which removals and demolition Work is performed.

B. Protections

Provide temporary barricades and other forms of protection required to protect RIOC and Department of Parks property, personnel, students and general public from injury due to selective removals and demolition work.

1. Provide protective measures as required to provide free and safe passage of students, RIOC personnel, Department of Parks personnel, and the general public.

2. Protect from damage existing finish work that is to remain in place and which becomes exposed during operations.

3. Protect floors with building paper or other suitable covering.

C. Damages

Promptly repair any and all damages to all property and finishes caused by the removals and demolition work; to the RIOC's satisfaction and at no extra cost to the RIOC.

D. Explosives

The use of explosives is prohibited.

E. Power-driven Tools (for interior removals and demolition).

Only hand-held electric power-driven tools conforming to the following criteria shall be used to cut or drill concrete and masonry:

1. Electric Chiselling Hammer

   a. Power Data 115 Volts AC
      7-8 Amps
      Three-wire grounded connection
   b. Percussion 2400-2600 Impacts/Minute
   c. Type/Size Hand-held (+ 18-inch length)
   d. Unit Weight 12-15 pounds (minus chisel bit)

2. Electric Hammer Drill

   a. Power Data 115 Volts AC

5-8 Amps
Three-wire grounded connection

b. Percussion 2400-3200 Impacts/Minute
c. Type/Size Hand-held (+ 18-inch length)
d. Unit Weight 12-15 pounds (minus chisel bit)
e. Speed Data 0-0500 RPM (Under load)

1.4 QUALITY ASSURANCE

A. Qualifications

1. Company specializing in performing the Work of this Section shall have a minimum of 3 years experience and shall have worked on 3 projects of similar size.

B. Regulatory Requirements

1. Work of this Section shall conform to all requirements of the NYC Building Code and all applicable regulations and guidelines of all governmental authorities having jurisdiction, including, but not limited to, safety, health, and anti-pollution regulations. Where more stringent requirements than those contained in the Building Code or other applicable regulations are given in this Section, the requirements of this Section shall govern.

2. Conform to the requirements of "Safety and Health Standards, Subpart P - Excavations, Trenching and Shoring" - OSHA.

PART 2 - PRODUCTS - NOT APPLICABLE

PART 3 - EXECUTION

3.1 INSPECTION

A. Prior to commencement of the selective removals and demolition Work, inspect the areas in which the Work will be performed. Determine and list the existing conditions of rooms or area surfaces and equipment. After the Work in each respective area is completed, determine if adjacent surfaces or equipment have been damaged as a result of the Work; if so, the damage shall be corrected at the Contractor's expense.

B. Create a safety zone around the demolition area as per Section BC 3306.2.1 of the 2014 NYC Building Code. Fences/barriers shall be erected to prevent persons other than workers from entering.

3.2 REMOVALS AND DEMOLITION WORK

A. Perform selective demolition Work in a systematic manner and use such methods as are required to complete the Work indicated, and in accordance with the Specifications and governing City, State, and Federal regulations.

B. When walls, partitions, floors, and ceilings (or portions thereof) are indicated to be removed; unless indicated otherwise:

1. Remove all items attached to the surfaces of the construction to be removed.

2. Remove all plumbing piping, fixtures, accessories and rough-in occurring on or in the construction to be removed; cap piping and/or re-route lines as indicated or required.

3. Remove all connectors, piping, ductwork and other HVAC items and accessories occurring on or in the construction to be removed; cap and/or re-route piping and ductwork as indicated or required.

4. Remove all electrical wiring, to include, but not limited to, lighting, communications, alarms and all related appurtenances, conduits, devices, fixtures, and other electrical items and accessories occurring on or in the construction to be removed; disconnect power and remove wiring and conduit back to source.

D. Carefully remove items, equipment and materials to be retained by the Department of Parks and deliver them to locations indicated in the Article titled "Ownership of Materials".

3.3 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove debris, rubbish and other materials resulting from the removals and demolitions from the building immediately; transport and legally dispose of materials off-site. Disposal method shall be in accordance with City, State, and Federal regulations. Items to be retained by the Department of Parks shall be delivered to locations indicated in the Article titled "Ownership of Materials".

B. Burning of removed materials is not permitted on the job site.

3.4 CLEAN-UP AND REPAIR

A. Upon completion of removals and demolition Work, remove tools, equipment and all remaining demolished materials from the site.

B. Repair all damaged areas caused by the removals and demolition Work. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

C. All areas in which Work was performed under this Section shall be left "broom-clean."

3.5 OWNERSHIP OF MATERIALS

A. All equipment, materials, and items removed shall remain the property of the Department of Parks, if desired; equipment, material and items not desired to be re-used or retained by the RIOC and the Department of Parks shall be removed from the site by the Contractor. The RIOC's Representative will designate which equipment, materials and items will be retained.

B. The items, equipment and materials listed in this Paragraph shall be removed and salvaged by the Contractor for future use by the Department of Parks and RIOC.

1. All existing pavers to be removed by this contract.
2. All wrought iron fences to be removed by this contract.
3. Existing chair lift

END OF SECTION 024119

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SECTION 033000 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

1.2 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

C. All materials, installation and workmanship shall comply with all applicable requirements and standards.

1.3 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:

1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."

2. ACI 318, "Building Code Requirements for Reinforced Concrete."

3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."

B. Mockup: Cast mockup of size indicated or as required to demonstrate typical joints, form tie spacing, and proposed surface finish, texture, and color. Maintain sample panel exposed to view for duration of Project, after Owner's acceptance of visual qualities.

1. Demolish mockup and remove from Site when directed by Owner.

1.4 SUBMITTALS

A. Product Data:

1. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry shake finish materials, and others if requested by Owner.

B. Samples:

1. Samples of materials including names, sources, and descriptions, as follows:

a. Color finishes.
b. Normal weight aggregates.
c. Fiber reinforcement.
d. Reglets.
e. Waterstops.
f. Vapor retarder/barrier.
g. Form liners.

C. Shop Drawings:

1. Shop Drawings for formwork indicating fabrication and erection of forms for specific finished concrete surfaces. Show form construction including jointing, special form joints or reveals, location and pattern of form tie placement, and other items that affect exposed concrete visually.

2. Shop Drawings for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures.

3. Review is for general architectural applications and features only. Designing formwork for structural stability and efficiency is Contractor's responsibility.

D. Record Documents:

1. Laboratory test reports for concrete materials and mix design test.

2. Material certificates in lieu of material laboratory test reports when permitted by Owner. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.2 FORM MATERIALS

A. Forms for Exposed Finish Concrete: Plywood, metal, metal framed plywood faced, or other acceptable panel type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on Drawings.

1. Use overlaid plywood complying with U.S. Product Standard PS 1 "A C or B B High Density Overlaid Concrete Form," Class I.

2. Use plywood complying with U.S. Product Standard PS 1 "B B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill oiled and edge sealed, with each piece bearing legible inspection trademark.

B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration to match Owner's control sample. Provide solid backing and form supports to ensure stability of textured form liners.

D. Forms for Cylindrical Columns and Supports: Metal, glass fiber reinforced plastic, or paper or fiber tubes that will produce smooth surfaces without joint indications. Provide units with sufficient wall thickness to resist wet concrete loads without deformation.

E. Pan Type Forms: Glass fiber reinforced plastic or formed steel, stiffened to support weight of placed concrete without deformation.

F. Carton Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

G. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

H. Form Ties: Factory fabricated, adjustable length, removable or snap off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches to the plane of the exposed concrete surface.

1. Provide ties that, when removed, will leave holes not larger than 1 inch in diameter in the concrete surface.

2.3 REINFORCING MATERIALS

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

B. Galvanized Reinforcing Bars: ASTM A 767, Class II (2.0 oz. zinc psf), hot dip galvanized after fabrication and bending.

C. Epoxy Coated Reinforcing Bars: ASTM A 775

D. Steel Wire: ASTM A 82, plain, cold drawn steel

E. Welded Wire Fabric: ASTM A 185, welded steel wire fabric

F. Deformed Steel Welded Wire Fabric: ASTM A 497

G. Epoxy Coated Welded Wire Fabric: ASTM A 884, Class A

H. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI specifications.

1. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

2. For exposed to view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I.

1. Use one brand of cement throughout Project unless otherwise acceptable to Owner.

B. Fly Ash: ASTM C 618, Type F.

C. Normal Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete.

1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.

2. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Owner.

D. Lightweight Aggregates: ASTM C 330

E. Water: Potable

F. Fiber Reinforcement: Polypropylene fibers engineered and designed for secondary reinforcement of concrete slabs, complying with ASTM C 1116, Type III. Subject to compliance with requirements, provide one of the following:

1. Gilco Fibers, Cormix Construction Chemicals

2. Durafiber, Durafiber Corp.

3. Fiberstrand 100, Euclid Chemical Co.

4. Fibermesh, Fibermesh Co., Div. Synthetic Industries, Inc.

5. Forta, Forta Corp.

6. Grace Fibers, W.R. Grace & Co.

7. Polystrand, Metalcrete Industries

G. Admixtures, General: Provide concrete admixtures that contain not more than 0.1 percent chloride ions.

H. Air Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures. Subject to compliance with requirements, provide one of the following:

1. Air Tite, Cormix Construction Chemicals

2. Air Mix or Perma Air, Euclid Chemical Co.

3. Darex AEA or Daravair, W.R. Grace & Co.

4. MB VR or Micro Air, Master Builders, Inc.

5. Sealtight AEA, W.R. Meadows, Inc.

6. Sika AER, Sika Corp.

I. Water Reducing Admixture: ASTM C 494, Type A. Subject to compliance with requirements, provide one of the following:

1. Chemtard, ChemMasters Corp.

2. PSI N, Cormix Construction Chemicals

3. Eucon WR 75, Euclid Chemical Co.

4. WRDA, W.R. Grace & Co.

5. Pozzolith Normal or Polyheed, Master Builders, Inc.

6. Metco W.R., Metalcrete Industries

7. Prokrete N, Prokrete Industries

8. Plastocrete 161, Sika Corp.

J. High Range Water Reducing Admixture: ASTM C 494, Type F or Type G. Subject to compliance with requirements, provide one of the following:

1. Super P, Anti Hydro Co., Inc.

2. Cormix 200, Cormix Construction Chemicals

3. Eucon 37, Euclid Chemical Co.

4. WRDA 19 or Daracem, W.R. Grace & Co.

5. Rheobuild or Polyheed, Master Builders, Inc.

6. Superslump, Metalcrete Industries

7. PSPL, Prokrete Industries

8. Sikament 300, Sika Corp.

K. Water Reducing, Accelerating Admixture: ASTM C 494, Type E. Subject to compliance with requirements, provide one of the following:

1. Q Set, Conspec Marketing & Manufacturing Co.

2. Lubricon NCA, Cormix Construction Chemicals

3. Accelguard 80, Euclid Chemical Co.

4. Daraset, W.R. Grace & Co.

5. Pozzutec 20, Master Builders, Inc.

6. Accel Set, Metalcrete Industries

L. Water Reducing, Retarding Admixture: ASTM C 494, Type D. Subject to compliance with requirements, provide one of the following:

1. PSI R Plus, Cormix Construction Chemicals

2. Eucon Retarder 75, Euclid Chemical Co.

3. Daratard 17, W.R. Grace & Co.

4. Pozzolith R, Master Builders, Inc.

5. Protard, Prokrete Industries

6. Plastiment, Sika Corp.

2.5 RELATED MATERIALS

A. Reglets: Where sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 0.0217 inch thick (26 gage) galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.

B. Dovetail Anchor Slots: Hot dip galvanized sheet steel, not less than 0.0336 inch thick (22 gage) with bent tab anchors. Fill slot with temporary filler or cover face opening to prevent intrusion of concrete or debris.

C. Waterstops: Provide bentonite strip type waterstops; "Volclay Waterstop RX" by American Colloid Co.

D. Waterstops: Provide flat, dumbbell type or centerbulb type waterstops at construction joints and other joints as indicated. Size to suit joints.

E. Rubber Waterstops: Corps of Engineers CRD C 513. Subject to compliance with requirements, provide products of one of the following:

1. The Burke Co.
2. Progress Unlimited
3. Williams Products, Inc.

F. Polyvinyl Chloride Waterstops: Corps of Engineers CRD C 572. Subject to compliance with requirements, provide products of one of the following:

1. The Burke Co.
2. Greenstreak Plastic Products Co.
3. W.R. Meadows, Inc.
4. Progress Unlimited
5. Schlegel Corp.
6. Vinylex Corp.

G. Sand Cushion: Clean, manufactured or natural sand

H. Vapor Retarder: Provide vapor retarder that is resistant to deterioration when tested according to ASTM E 154, as follows:

1. Polyethylene sheet not less than 8 mils thick.
2. Water resistant barrier consisting of heavy kraft papers laminated together with glass fiber reinforcement and overcoated with black polyethylene on each side.
   a. Product: Subject to compliance with requirements, provide Moistop by Fortifiber Corporation.

I. Vapor Barrier: Premolded seven ply membrane consisting of reinforced core and carrier sheet with fortified bitumen layers, protective weathercoating, and plastic antistick sheet. Water vapor transmission rate of 0.00 grains per square foot per hour when tested according to ASTM E 96, Method B. Provide manufacturer's recommended mastics and gusset tape.

1. Product: Subject to compliance with requirements, provide Sealtight Premoulded Membrane by W.R. Meadows, Inc.

J. Nonslip Aggregate Finish: Provide fused aluminum oxide granules or crushed emery as the abrasive aggregate for a nonslip finish, with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory graded, packaged, rustproof, nonglazing, and unaffected by freezing, moisture, and cleaning materials.

K. Colored Wear Resistant Finish: Packaged dry combination of materials consisting of portland cement, graded quartz aggregate, coloring pigments, and plasticizing admixture. Use coloring pigments that are finely ground nonfading mineral oxides interground with cement. Color as selected by Owner from manufacturers' standards, unless otherwise indicated. Subject to compliance with requirements, provide one of the following:

1. Conshake 600 Colortone, Conspec Marketing & Mfg. Co.
2. Floorcron, Cormix Construction Chemicals
3. Quartz Tuff, Dayton Superior
4. Surflex, Euclid Chemical Co.
5. Colorundum, A.C. Horn, Inc.
6. Quartz Plate, L&M Construction Chemicals, Inc.
7. Colorcron, Master Builders, Inc.
8. Floor Quartz, Metalcrete Industries
9. Lithochrome Color Hardener, L.M. Scofield Co.
10. Harcol Redi Mix, Sonneborn Chemrex
11. Hard Top, Symons Corp.

L. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

M. Moisture Retaining Cover: One of the following, complying with ASTM C 171.

1. Waterproof paper
2. Polyethylene film
3. Polyethylene coated burlap

N. Liquid Membrane Forming Curing Compound: Liquid type membrane forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.55 kilograms per square meter when applied at 200 square feet per gallon.

1. Provide material that has a maximum volatile organic compound (VOC) rating of 350 millograms per liter.
2. Products: Subject to compliance with requirements, provide one of the following:
   a. A H 3 Way Sealer, Anti Hydro Co., Inc.
   b. Spartan Cote, The Burke Co.
   c. Conspec #1, Conspec Marketing & Mfg. Co.
   d. Sealco 309, Cormix Construction Chemicals

e. Day Chem Cure and Seal, Dayton Superior Corp.
f. Eucocure, Euclid Chemical Co.
g. Horn Clear Seal, A.C. Horn, Inc.
h. L&M Cure R, L&M Construction Chemicals, Inc.
i. Masterkure, Master Builders, Inc.
j. CS 309, W.R. Meadows, Inc.
k. Seal N Kure, Metalcrete Industries
l. Kure N Seal, Sonneborn Chemrex
m. Stontop CS2, Stonhard, Inc.

O. Water Based Acrylic Membrane Curing and Sealing Compound: ASTM C 309, Type I, Class B. Subject to compliance with requirements, provide one of the following:

1. Highseal, Conspec Marketing and Mfg. Co.
2. Sealco VOC, Cormix Construction Chemicals
3. Safe Cure and Seal, Dayton Superior Corp.
4. Aqua Cure, Euclid Chemical Co.
5. Dress & Seal WB, L&M Construction Chemicals, Inc.
6. Masterkure 100W, Master Builders, Inc.
7. Vocomp 20, W.R. Meadows, Inc.
8. Metcure, Metalcrete Industries
9. Stontop CS1, Stonhard, Inc.

P. Evaporation Control: Monomolecular film forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss. Subject to compliance with requirements, provide one of the following:

1. Aquafilm, Conspec Marketing and Mfg. Co.
2. Eucobar, Euclid Chemical Co.
3. E Con, L&M Construction Chemicals, Inc.
4. Confilm, Master Builders, Inc.
5. Waterhold, Metalcrete Industries

Q. Underlayment Compound: Free flowing, self leveling, pumpable, cement based compound for applications from 1 inch thick to feathered edges. Subject to compliance with requirements, provide one of the following:

1. Ardex, Inc. "K-15"
2. Conspec Marketing and Mfg. Co. "Conflow"

3. Dayton Superior Corp. "LevelLayer II"

4. Euclid Chemical Co. "Flo-Top"

5. L&M Construction Chemicals, Inc. "Levelex"

6. Master Builders, Inc. "Pourcrete"

7. Sonneborn, "SonoFlow"

R. Bonding Agent: Polyvinyl acetate or acrylic base. Subject to compliance with requirements, provide one of the following:

1. Polyvinyl Acetate (Interior Only):

   a. Superior Concrete Bonder, Dayton Superior Corp.
   b. Euco Weld, Euclid Chemical Co.
   c. Weld Crete, Larsen Products Corp.
   d. Everweld, L&M Construction Chemicals, Inc.
   e. Herculox, Metalcrete Industries
   f. Ready Bond, Symons Corp.

2. Acrylic or Styrene Butadiene:

   a. Acrylic Bondcrete, The Burke Co.
   b. Strongbond, Conspec Marketing and Mfg. Co.
   c. Day Chem Ad Bond, Dayton Superior Corp.
   d. SBR Latex, Euclid Chemical Co.
   e. Daraweld C, W.R. Grace & Co.
   f. Hornweld, A.C. Horn, Inc.
   g. Everbond, L&M Construction Chemicals, Inc.
   h. Acryl Set, Master Builders Inc.
   i. Intralok, W.R. Meadows, Inc.
   j. Acrylpave, Metalcrete Industries
   k. Sonocrete, Sonneborn Chemrex
   l. Stonlock LB2, Stonhard, Inc.
   m. Strong Bond, Symons Corp.

S. Epoxy Adhesive: ASTM C 881, two component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements. Subject to compliance with requirements, provide one of the following:

1. Burke Epoxy M.V., The Burke Co.

2. Spec Bond 100, Conspec Marketing and Mfg. Co.

3. Resi Bond (J 58), Dayton Superior

4. Euco Epoxy System #452 or #620, Euclid Chemical Co.

5. Epoxtite Binder 2390, A.C. Horn, Inc.

6. Epabond, L&M Construction Chemicals, Inc.

7. Concresive Standard Liquid, Master Builders, Inc.

8. Rezi Weld 1000, W.R. Meadows, Inc.

9. Metco Hi Mod Epoxy, Metalcrete Industries

10. Sikadur 32 Hi Mod, Sika Corp.

11. Stonset LV5, Stonhard, Inc.

12. R 600 Series, Symons Corp.

2.6 PROPORTIONING AND DESIGNING MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use an independent testing agency acceptable to Owner for preparing and reporting proposed mix designs.

1. Do not use the same testing agency for field quality control testing.

2. Limit use of fly ash to not exceed 25 percent of cement content by weight.

B. Submit written reports to Owner of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Owner.

C. Design mixes to provide normal weight concrete with the following properties as indicated on Drawings and schedules:

1. 4000 psi, 28 day compressive strength; water cement ratio, 0.44 maximum (non air entrained), 0.35 maximum (air entrained).

2. 3500 psi, 28 day compressive strength; water cement ratio, 0.51 maximum (non air entrained), 0.40 maximum (air entrained).

3. 3000 psi, 28 day compressive strength; water cement ratio, 0.58 maximum (non air entrained), 0.46 maximum (air entrained).

4. 2500 psi, 28 day compressive strength; water cement ratio, 0.67 maximum (non air entrained), 0.54 maximum (air entrained).

D. Water Cement Ratio: Provide concrete for following conditions with maximum water cement (W/C) ratios as follows:

1. Subjected to freezing and thawing: W/C 0.45.

2. Subjected to deicers/watertight: W/C 0.40.

3. Subjected to brackish water, salt spray, or deicers: W/C 0.40.

E. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Ramps, slabs, and sloping surfaces: Not more than 3 inches.

2. Reinforced foundation systems: Not less than 1 inch and not more than 3 inches.

3. Concrete containing high range water reducing admixture (superplasticizer): Not more than 8 inches after adding admixture to Site verified 2 to 3 inch slump concrete.

4. Other concrete: Not more than 4 inches.

F. Lightweight Structural Concrete: Lightweight aggregate and concrete shall conform to ASTM C 330. Proportion mix to produce concrete with a minimum compressive strength of 3000 psi at 28 days and a calculated equilibrium unit weight of 110 pcf plus or minus 3 pcf as determined by ASTM C 567. Concrete slump at the point of placement shall be the minimum necessary for efficient mixing, placing, and finishing. Maximum slump shall be 6 inches for pumped concrete and 5 inches elsewhere. Air entrain concrete exposed to weather according to ACI 301 requirements.

G. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Owner. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Owner before using in Work.

H. Fiber Reinforcement: Add to mix at rate of 1.5 lb per cu. yd. unless otherwise recommended by manufacturer.

2.7 ADMIXTURES

A. Use water reducing admixture or high range water reducing admixture (superplasticizer) in concrete, as required, for placement and workability.

B. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 degrees F (10 degrees C).

C. Use high range water reducing admixture in pumped concrete, concrete for heavy use industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, and concrete with water cement ratios below 0.50.

D. Use air entraining admixture in exterior exposed concrete unless otherwise indicated. Add air entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1½ percent within the following limits:

1. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure:

a. 4.5 percent (moderate exposure); 5.5 percent (severe exposure) for 1½ inch maximum aggregate.

b. 4.5 percent (moderate exposure); 6.0 percent (severe exposure) for 1 inch maximum aggregate.
c. 5.0 percent (moderate exposure); 6.0 percent (severe exposure) for ¾ inch maximum aggregate.
d. 5.5 percent (moderate exposure); 7.0 percent (severe exposure) for ½ inch maximum aggregate.

2. Other concrete not exposed to freezing, thawing, or hydraulic pressure, or to receive a surface hardener: 2 to 4 percent air.

E. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.

2.8 CONCRETE MIXING

A. Job Site Mixing: Mix concrete materials in appropriate drum type batch machine mixer. For mixers of 1 cubic yard or smaller capacity, continue mixing at least 1½ minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than 1 cubic yard, increase minimum 1½ minutes of mixing time by 15 seconds for each additional cubic yard.

1. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.

B. Ready Mixed Concrete: Comply with requirements of ASTM C 94, and as specified.

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

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel.

3.2 INSTALLATION

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. All installation shall be in accordance with manufacturer’s published recommendations.

3.3 FORMS

A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:

1. Provide Class A tolerances for concrete surfaces exposed to view.

2. Provide Class C tolerances for other concrete surfaces.

B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.

D. Provide temporary openings for clean outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.

E. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.4 VAPOR RETARDER/BARRIER INSTALLATION

A. General: Place vapor retarder/barrier sheeting in position with longest dimension parallel with direction of pour.

B. Lap joints 6 inches and seal with manufacturer's recommended mastic or pressure sensitive tape.

1. Cover vapor retarder/barrier with sand cushion and compact to depth indicated.

3.5 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.

1. Avoiding cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Owner.

D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.6 JOINTS

A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Owner.

B. Provide keyways at least 1½ inches deep in construction joints in walls and slabs and between walls and footings. Bulkheads designed and accepted for this purpose may be used for slabs.

C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.

D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

E. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Support and protect exposed waterstops during progress of Work. Field fabricate joints in waterstops according to manufacturer's printed instructions.

F. Isolation Joints in Slabs on Grade: Construct isolation joints in slabs on grade at points of contact between slabs on grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

G. Contraction (Control) Joints in Slabs on Grade: Construct contraction joints in slabs on grade to form panels of patterns as shown. Use saw cuts 1/8 inch wide by one fourth of slab depth or inserts 1/4 inch wide by one fourth of slab depth, unless otherwise indicated.

1. Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

2. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.

3. If joint pattern is not shown, provide joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).

4. Joint fillers and sealants are specified in Division 07 Section "Joint Sealants."

3.7 INSTALLING EMBEDDED ITEMS

A. General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast in place concrete. Use setting Drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

B. Install reglets to receive top edge of foundation sheet waterproofing and to receive through wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.

C. Install dovetail anchor slots in concrete structures as indicated on Drawings.

D. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike off templates or compacting type screeds.

3.8 PREPARING FORM SURFACES

A. General: Coat contact surfaces of forms with an approved, nonresidual, low VOC, form coating compound before placing reinforcement.

B. Do not allow excess form coating material to accumulate in forms or come into contact with in place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.

1. Coat steel forms with a nonstaining, rust preventative material. Rust stained steel formwork is not acceptable.

3.9 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.

2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.

1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.

2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

3. Maintain reinforcing in proper position on chairs during concrete placement.

F. Cold Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

G. When air temperature has fallen to or is expected to fall below 40 degrees F (4 degrees C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F (10 degrees C) and not more than 80 degrees F (27 degrees C) at point of placement.

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

2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

H. Hot Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 degrees F (32 degrees C). Mixing water may be chilled 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. Cover reinforcing steel with water soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.

3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.

4. Use water reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Owner.

3.10 FINISHING FORMED SURFACES

A. Rough Formed Finish: Provide a rough formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.

B. Smooth Formed Finish: Provide a smooth formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as cast concrete surface obtained with selected form facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

C. Smooth Rubbed Finish: Provide smooth rubbed finish on scheduled concrete surfaces that have received smooth formed finish treatment not later than 1 day after form removal.

1. 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.

D. Grout Cleaned Finish: Provide grout cleaned finish on scheduled concrete surfaces that have received smooth formed finish treatment.

1. Combine one part portland cement to one and one half parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene based bonding admixture and water to form the consistency of thick paint. Blend standard portland cement and white portland cement in amounts determined by trial patches so that final color of dry grout will match adjacent surfaces.

2. Thoroughly wet concrete surfaces, apply grout to coat surfaces, and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

E. 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 MONOLITHIC SLAB FINISHES

A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and where indicated.

1. After placing slabs, finish surface to tolerances of F(F) 20 (floor flatness) and F(L) 15 (floor levelness) measured according to ASTM E 1155. Slope surfaces uniformly to drains where indicated. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.

B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand bed terrazzo; and where indicated.

1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power driven floats, or both. Consolidate surface with power driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to tolerances of F(F) 18 (floor flatness) and F(L) 15 (floor levelness) measured according to ASTM E 1155. Cut down high spots and fill low spots. Uniformly slope surfaces to drains where indicated. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film finish coating system.

1. Uniformly slope surfaces to drains where indicated. After floating, begin first trowel finish operation using a power driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances of F(F) 20 (floor flatness) and F(L) 17 (floor levelness) measured according to ASTM E 1155. Grind smooth any surface defects that would telegraph through applied floor covering system.

D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.

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

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

F. Nonslip Aggregate Finish: Apply nonslip aggregate finish to concrete stair treads, platforms, ramps, sloped walks, and where indicated.

1. After completing float finishing and before starting trowel finish, uniformly spread 25 pounds of dampened nonslip aggregate per 100 square feet of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as specified.

2. After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose nonslip aggregate.

G. Colored Wear Resistant Finish: Apply a colored wear resistant finish to monolithic slab surface indicated.

1. Apply dry shake materials for the colored wear resistant finish at a rate of 100 pounds per 100 square feet, unless a greater amount is recommended by material manufacturer.

2. Cast a trial slab approximately 10 feet square to determine actual application rate, color, and finish, as acceptable to Owner.

3. Immediately following the first floating operation, uniformly distribute with mechanical spreader approximately two thirds of the required weight of the dry shake material over the concrete surface, and embed by power floating. Follow floating operation with second shake application, uniformly distributing remainder of dry shake material with overlapping applications to ensure uniform color, and embed by power floating.

4. After broadcasting and floating, apply a trowel finish as specified. Cure slab surface with a curing compound recommended by the dry shake material manufacturer. Apply the curing compound immediately after the final finishing.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in place construction. Provide other miscellaneous concrete filling shown or required to complete 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. Floor Drains: At all interior floor drain locations, where the entire floor is not indicated to slope to drain, provide a depressed sump approximately 1 inch deep and 12 inches to 18 inches in diameter in the surface of the concrete to facilitate drainage.

D. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

E. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast in safety inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

F. Identification:

1. Identify the underside of all post-tensioned concrete beams with the words “POST TENSIONED BEAM - DO NOT DRILL”. Provide 3” high, red stenciled lettering repeated at 20’ intervals, maximum, for beams longer than 20’.

2. Identify the underside of all post-tensioned concrete slabs with the words “POST TENSIONED SLAB - DO NOT DRILL”. Provide painted 3” high, red stenciled lettering, located in each structural bay and at a maximum of 500 square feet intervals.

3.13 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

C. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture retaining cover curing, or by combining these methods, as specified.

D. Provide moisture curing by the following methods:

1. Keep concrete surface continuously wet by covering with water.

2. Use continuous water fog spray.

3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4 inch lap over adjacent absorptive covers.

E. Provide moisture retaining cover curing as follows:

1. Cover concrete surfaces with moisture retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

F. Apply curing compound on exposed interior slabs and on exterior slabs, walks, and curbs as follows:

1. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

2. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

G. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

H. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.

1. Final cure concrete surfaces to receive finish flooring with a moisture retaining cover, unless otherwise directed.

3.14 SHORES AND SUPPORTS

A. General: Comply with ACI 347 for shoring and reshoring in multistory construction, and as specified.

B. Extend shoring from ground to roof for structures four stories or less, unless otherwise permitted.

C. Extend shoring at least three floors under floor or roof being placed for structures over four stories. Shore floor directly under floor or roof being placed, so that loads from construction above will transfer directly to these shores. Space shoring in stories below this level in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members where no reinforcing steel is provided. Extend shores beyond minimums to ensure proper distribution of loads throughout structure.

D. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to support work without excessive stress or deflection.

E. Keep reshores in place a minimum of 15 days after placing upper tier, or longer, if required, until concrete has attained its required 28 day strength and heavy loads due to construction operations have been removed.

3.15 REMOVING FORMS

A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F (10 degrees C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in place concrete by testing field cured specimens representative of concrete location or members.

C. Form facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

3.16 REUSING FORMS

A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Owner.

3.17 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Owner.

B. Mix dry pack mortar, consisting of one part portland cement to 2½ parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.

1. Cut out honeycombs, rock pockets, voids over ¼ inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.

2. For surfaces exposed to view, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas 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.

C. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Owner. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry pack mortar or precast cement cone plugs secured in place with bonding agent.

1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.

1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.

2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.

3. Correct low areas in unformed surfaces 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. Proprietary underlayment compounds may be used when acceptable to Owner.

4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least ¾ inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

E. Repair isolated random cracks and single holes 1 inch or less in diameter by dry pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry pack before bonding agent has dried. Compact dry pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

F. Perform structural repairs with prior approval of Owner for method and procedure, using specified epoxy adhesive and mortar.

G. Repair methods not specified above may be used, subject to acceptance of Owner.

3.18 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. The Owner will employ a testing agency to perform tests and to submit test reports.

B. Sampling and testing for quality control during concrete placement may include the following, as directed by Owner.

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

a. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
b. 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 pour of each type of air entrained concrete.
c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive strength specimens.
d. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field cured test specimens are required.

e. Compressive Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cubic yards more than the first 25 cubic yards of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.

3. When total quantity of a given class of concrete is less than 50 cubic yards, Owner may waive strength testing if adequate evidence of satisfactory strength is provided.

4. When strength of field cured cylinders is less than 85 percent of companion laboratory cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in place concrete.

5. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.

C. Test results will be reported in writing to Owner, Structural Engineer, ready mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, 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 tests and 28 day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

E. Additional Tests: The testing agency 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 Owner. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

END OF SECTION 033000

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SECTION 036100 - GROUTING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Furnish material, equipment, labor, services required to provide non-shrink grout. Work includes, but is not limited to grouting under steel and mechanical equipment base plates, filling of fence and rail posts sleeves, grouting of piping, and wherever else shown on Drawings.

1.2 RELATED SECTIONS

A.	Structural Steel	Section 051200
B.	Metal Fabrications	Section 055000
C.	Ornamental Metal	Section 057000

1.3 REFERENCES

References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

A. American Society of Testing and Materials (ASTM) Standards, latest editions.

ASTM C109	Test Method for Compressive Strength of Hydraulic Cement Mortars.
ASTM C191	Standard Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle
ASTM C1090	Standard Test Method for Measuring Changes in Height of Cylindrical Specimens of Hydraulic-Cement Grout
ASTM C1107	Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).

B. Army Corp of Engineers

CRD C-621 Specification for Non-Shrink Grout.

1.4 SUBMITTALS

A. Product Data

Submit manufacturer's information on the non-shrink grout, including mixing and installation instructions for each type of application.

B. Quality Control Submittals

1. Qualifications

Provide proof of Manufacturer and Installer qualifications specified under "Quality Assurance".

1.5 QUALITY ASSURANCE

A. Qualifications

1. Manufacturer: Company specializing in the production of grout shall have a minimum of five years' experience.

2. Installer: Company specializing in performing the work of this section shall have three years minimum experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered in manufacturer's sealed and undamaged packaging. Each package shall contain clear and legible labels that meet requirements of local, state and federal regulations identifying manufacturer's name, product name, quantity of material, and batch number.

B. Protect material from the elements and from other damage at site.

C. Replace and pay for material and work damaged to the satisfaction of the RIOC.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not apply grout at temperatures below 40°F or higher than 90°F. Follow manufacturer's recommendations for placement temperatures, which is typically at an optimum range of 50°F to 80°F. Provide hot and cold weather procedures at other temperatures as per ACI 305R and ACI 306R respectively.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Grout

1. Sika Corp., Lyndhurst, NJ 07071

2. Euclid Chemical Company, Cleveland, OH 44110

3. Five Star Products, Inc., Fairfield, CT 06824

4. HiltiInc., Tulsa, OK 74146

5. Mapei, Deerfield Beach, FL 33442

2.2 MATERIALS

A. Grout

1. Grout shall be non-shrink, non-metallic, cement based material meeting ASTM 1107 and CRD C-621 with the following characteristics:

a. Minimum compressive strength of 6000 psi @ 28 days when testing in accordance with ASTM C109 or CRD C-621.
b. Slight positive expansion when tested in accordance with CRD C-621 or ASTM C1090.

2. Products:

a. SikaGrout 212 by Sika Corp.
b. Dry Pack Grout and NS Grout by Euclid Chemical Company
c. "Five Star Grout" by U.S. Grout Corp.
d. Multipurpose Grout by Hilti, Inc.
e. Precision Grout by Hilti, Inc.
f. Planigrout 712 by Mapei

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine all adjoining work on which this Work is in anyway dependent for proper installation and workmanship. Report to the RIOC any condition that prevents the performance of this Work.

B. Repair surfaces to receive grout as approved by the Engineer of Record to ensure that the maximum allowed thickness of material is not exceeded.

3.2 SURFACE PREPARATION

A. Concrete surface shall be free of all loose material.

B. All metal components shall be clean and free of corrosion.

C. Surfaces and metal components shall be free of oil, grease, loose paint, corrosive deposits, dust, laitance and other contaminants.

D. Sleeves and holes shall be clean of water, dust and debris.

3. 3 APPLICATION

A. Perform all grouting in accordance with the recommendations of ACI, CSI, and the grout manufacturer's published specifications for site preparation, product mixing, and placing. For grouting in weather below 50°F, contact manufacturer for cold weather instructions.

B. Arrange with the manufacturer of the grout for the services of a qualified field representative to instruct the work crews in the mixing of components, preparation of surfaces, technique of installation, and inspection procedures.

C. Place grout at a no more than “flowable” consistency as required by the application, carefully using the manufacturer’s recommended water content for Dry Pack, Plastic or Flowable consistencies.

D. Locations

1. Provide grout 1" thick minimum, 2” thick maximum, unless otherwise specified, under column base plates and beam bearing plates. Work grout under plates to provide full and even bearing. Grouting is to be done prior to placement of any concrete on the structure.

2. Provide grout for grouting fence posts into sleeves. Grout is to be placed at a “plastic” consistency and crowned at the post to shed water away from the post onto the adjoining concrete surface.

3. Provide grout for grouting bars in concrete and for "Dry Packing". Follow manufacturer's procedure for mixing and installation.

4. Provide grout under equipment bases.

5. Provide for grouting in pipes entering precast units.

6. Provide grout wherever else it is indicated on Drawings or Specifications.

E. Follow manufacturer's instructions for curing.

3.4 PROTECTION AND CLEANING

A. Clean all adjacent area of excess material and clean all floors and walls of powder and droppings.

3.5 FIELD QUALITY CONTROL

A. The RIOC's Testing Laboratory will inspect the grouting procedure and take cube specimens to test compressive strength.

B. The RIOC will inspect and reject any that are of inadequate strength or contains cracks or other defects. These areas shall be fixed at contractor's expense.

C. Engage the services of the material manufacturer's representative to instruct in the proper mixing and usage of the material to ensure the grout is placed at the correct consistency and manner.

END OF SECTION 036100

* * *

SECTION 051200 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Furnish and erect all structural steel as shown on Drawings. Provide shop painting and galvanizing as specified.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Anchor Bolts for Structural Steel for Casting into Concrete.....Section 033000

1.3 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Loose Bearing and Base Plates for Structural Steel.....Section 055000

1.4 RELATED SECTIONS

A. Grouting.....Section 036100

B. Metal Deck .....Section 053000

C. Steel Stairs.....Section 057100

D. Painting.....Section 099000

1.5 REFERENCES

References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

A. American Society of Testing and Materials (ASTM) standards, latest editions.

A6 Standard Specification for General Requirements for Rolled Steel Bars, Plates, Shapes, and Sheet Piling.

A29 Standard Specification for Steel Bars, Carbon and Alloy, Hot-Wrought, General Requirements for

A36 Standard Specification for Carbon Structural Steel.

A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-

Coated, Welded and Seamless.

A108 Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality.

A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

A153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

A194 Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service, or Both.

A307 Standard Specification for Carbon Steel Bolts and Studs, 60000 psi Tensile Strength.

A325 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

A490 Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.

A500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

A563 Standard Specification for Carbon and Alloy Steel Nuts.

A780 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coating.

A992 Standard Specification for Steel for Structural Shapes for Use in Building Framing

F436 Standard Specification for Hardened Steel Washers

F1554 Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

F1852 Standard Specification for “Twist Off” Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

F2280 Standard Specification for “Twist Off” Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 150 ksi Minimum Tensile Strength

B. "Specification for Structural Steel Buildings" - American Institute of Steel Constructors (AISC 360-05).

C. “Seismic Provisions for Structural Steel Buildings, including Supplement No. 1 dated 2005 (AISC 341-05).

D. "Code of Standard Practice for Steel Buildings and Bridges" (AISC 303).

E. "Standard Welding Symbols - A2.0" - American Welding Society (AWS).

F. "Specification for Mild Steel Covered Arc-Welding Electrodes - A5.1" - AWS.

G. "Specification for Low-Alloy Steel Covered Arc-Welding Electrodes - A5.5" - AWS.

H. "Structural Welding Code - D1.1" - AWS.

I. "Solvent Cleaning - SP1" - Steel Structures Painting Council (SSPC).

J. "Hand Tool Cleaning - SP2" - SSPC.

K. "Power Tool Cleaning - SP3" - SSPC.

L. "Commercial Blast Cleaning - SP6" - SSPC.

M. "Pickling - SP8" - SSPC.

N. "Near-white Blast Cleaning – SP10" - SSPC.

1.6 DEFINITIONS

A. Structural Steel

Structural Steel consists of the steel elements of the structural steel frame essential to support the design loads. These elements consist of material as shown on the structural steel plan and listed in Article 2.1 of the AISC "Code of Standard Practice for Steel Buildings and Bridges.”

B. Other Steel

Structural steel does not apply to those elements listed in Article 2.2 of the AISC "Code of Standard Practice for Steel Buildings and Bridges.”

1.7 SUBMITTALS

A. Product Data

Submit manufacturers' specifications for the following products:

1. Primer paints, galvanizing repair paint

2. Stud shear connectors

3. Expansion/adhesive anchors

4. Zinc Metallizing

B. Shop Drawings

1. Failure to submit legible shop drawings will be cause for return without review.

2. All connections shall be designed by and all drawings shall be prepared under supervision of a Professional Engineer licensed in the State of New York. Do not submit unchecked shop drawings. First submissions of all job standards, shop drawings of connections not shown on, or that are in deviation of, the job standards, and calculations shall have one set sealed and signed by the Engineer. After final approval of all shop drawings, submit a final set sealed and signed by the Professional Engineer.

3. Shear connections (framed beam, seated beam, single plate, etc.) shall be designed by the detailer's licensed engineer and detailed by the structural steel detailer, unless otherwise shown on Drawings. All wind and seismic connections (moment connections, bracing, etc.) are generally detailed on the Drawings. Based on the indicated loads (axial force, moment, etc.), the structural steel detailer's engineer shall design the connections. Those not detailed shall be detailed by the structural steel detailer.

4. Immediately after award of Contract and before preparing steel shop drawings, submit for review a set of job standards showing all necessary joint details with full particulars of connection pieces, shop and field welds, and holes for erection bolts and permanent bolts. These shall include any moment and shear connection designed by the Engineer of Record as well as those designed by the detailer. Appropriate marks for designating all types and sizes of joint details shall be included. Submit all calculations pertaining to the job standards. After approval of these job standards, the erection plans are to be submitted and shall be marked to indicate unmistakably the type and size of joint to be used for every beam connection. Do not order steel in advance of approval of the job standards and the erection plans with joint marks, except at own risk.

5. Prepare remainder of steel shop drawings after approval of job standards and erection plans. Drawings submitted prior to approval of job standards will be returned without review. Submit drawings gradually and not all at the same time so that sufficient time is allowed for checking and approval. No more than 100 drawings are to be submitted within a 14-day period to allow for checking and approval of package before submittal of next package. Shop Drawings for MEP equipment dunnage and access platforms shall not be submitted until after approval of the submitted MEP units. Ensure shop drawings submitted for MEP equipment dunnage and access platforms are coordinated and based on unit approved, which may vary substantially from the Basis of Design. The Contractor shall take

into account in their schedule the potential time impact in the sequencing of the steel drawings.

6. Steel shop drawings shall include framing plans, bolted and welded work, and details such as camber and other pertinent data not shown on job standards. Detail openings and reinforcement due to other Work. Coordinate with Drawings of other Work.

7. Indicate welds by standard AWS symbols and show size, length, and type of each weld in accordance with AWS A2.0.

8. Identify columns using same identification system shown on Drawings.

9. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed under other Sections.

10. Shop drawings will be checked for size of material and strength of connection by the Engineer of Record, which shall not render the Engineer of Record responsible for any errors in construction dimensions, etc. that have been made in preparation of shop drawings. The Contractor shall assume full responsibility for the correctness of dimensions and fit.

11. Submit calculations for design of connections on job standard and all other connections such as moment, brace, and trusses.

12. After shop drawings are 100% complete and approved and all field changes have been made, a CD rom of the as-built drawings are to be submitted to the RIOC in an AutoCad format.

C. Quality Control Submittals

1. Certificates and Affidavits

a. Furnish bolt manufacturer's test reports, covering physical and chemical tests, for each lot of high strength bolts submitted.
b. Furnish steel manufacturer's certificate certifying welders employed on the Work are current with their AWS qualifications (including having their required maintenance forms from their employer) and for work performed in the field are NYC licensed welders as per Section §28-407.1 of the NYC Administrative Code.
c. Furnish complete listing of ASTM's of materials listed in Part 2 of this Section and certification that materials supplied meet those listed.
d. For mechanical and adhesive anchors installed in concrete, submit ICC certification for use in cracked concrete.

2. Contractor Qualifications

a. Provide proof of Fabricator, Erector, Detailer/Engineer, and Adhesive Anchor Installer specified under “Quality Assurance”.
b. Provide proof of Zinc Metallizer’s qualifications specified under “Quality Assurance”; certification of qualifications meeting Military Standard by one of the following:
1) A branch of the U.S. Dept. of Defense (DoD), or
2) A company certified by U.S. Dept. of Defense; submit DoD certification for this company, or
3) The Society for Protective Coatings (SSPC).
c. Hot Dip Galvanizer/Powder Coating Applicator: Provide proof of Galvanizer/Applicator’s qualifications by submittal of the following:
1) Galvanizer’s written Quality Control/Quality Assurance manual for hot dip galvanizing and factory applied coatings.
2) Certification from the American Galvanizers Association that Galvanizer has completed all course requirements and is a certified Master Galvanizer.

D. Surveys

Submit signed and sealed copies of surveys conducted by a Licensed Land Surveyor of items listed in Part 3 of this Section and the Drawings.

E. Test Reports

Submit test reports for zinc metallizing and epoxy coating system as specified herein, paragraph titled “Galvanizing by the Zinc Metallizing Process”.

F. Sustainability Submittals

1. Recycled Content

a. Submit documentation of recycled content of structural steel; product data or manufacturer’s statement as applicable.
b. Submit Contractor’s Sustainable Materials Form with complete information on recycled for structural steel provided under this section in accordance with Section S01352, Sustainability Requirements. Include cost of materials and percentage, by weight, of materials that have recycled content.

2. Regional Content

a. Submit documentation of regional materials for structural steel; product data or manufacturer’s statement as applicable.
b. Submit Contractor’s Sustainable Materials Form with complete information on regional content for structural steel provided under this section in accordance with Section S01352, Sustainability

Requirements. Include cost of materials and distance to point of materials extraction and manufacture.

1.8 QUALITY ASSURANCE

A. Qualifications

1. Fabricator: Company specializing in the fabrication of steel products to be used in this Contract shall have a minimum of five years' experience. The fabricator is to be AISC certified.

2. Erector: Company specializing in performing the Work of this Section shall have a minimum of three years' experience and have done at least three projects with similar quantity of material.

3. Detailer: Company shall be specialized in the detailing and design of structural steel shop drawings with a minimum of three years' experience. Connections shall be designed by and shop drawings prepared under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed by the State of NY engaged.

4. Adhesive Anchor Installer: Installer for adhesive anchors installed in a horizontal or upwardly inclined position supporting sustained tension loads shall be certified per ACI Appendix D9.2.2 as per Section BC 1912 of the 2014 NYC Building Code.

5. Zinc metallizer: The company or individual responsible for application of zinc metallizing shall be certified as qualified to perform this process by one of the following:

   a. Certification in accordance with Mil Std 2138 or Mil Std 1687 by a branch of the U.S. Dept. of Defense, or by a company that is certified by the Dept. of Defense in accordance with either one of these military standards.
   b. Thermal Spray Certification by The Society for Protective Coatings (SSPC).

   The firm providing the zinc metallizing shall also perform the painting of the members at the shop also to provide a single source responsibility.

6. Hot-Dip Galvanizer/Powder Coating Applicator: The company or individual responsible for application of hot dip galvanizing with a powder coat finish shall be certified as qualified to perform this process by the following:

   a. Certification from the American Galvanizers Association that Galvanizer has completed all course requirements and is a certified Master Galvanizer.

b. Certification from the manufacturer of the powder coatings that the galvanizer is an approved applicator of said manufacturer's material and meets all application and performance criteria.

B. Regulatory Requirements

1. Building Code: Work of this Section shall conform to all requirements of the 2014 NYC Building Code and all applicable regulations of governmental authorities having jurisdiction, including safety, health, noise, and anti-pollution regulations. Where more severe requirements than those contained in the Building Code are given in this Section, the requirements of this Section shall govern.

2. New York City Board of Standards and Appeals (BSA): Rules for Arc and Gas Welding and Oxygen Cutting and Steel Covering the Specifications for Design, Fabrication, and Inspection of Arc and Gas Welded Steel Structures and Qualification of Welders and Supervisors.

3. Industry Standards: Standards specified herein apply to Work of this Section. Where more severe requirements then those contained in the Standards are given in this Section or the Building Code, requirements of this Section or the Building Code shall govern.

a. "Code of Standard Practice for Steel Buildings and Bridges" – AISC 303-05. Modification to the code shall be as follows:

1) Paragraph Glossary Definitions:

a) Modify "Structural Engineer of Record" to read "The RIOC's designated representative for the preparation of the plans and specifications."

b) Modify "Owner's designated representative for construction" to read "The RIOC's designated representative for construction of the structure."

c) Modify "Owner" to read "The Owner for the purpose of construction of the proposed school building is the NYC School Construction RIOC. In Section 7.2 through 7.16, the owner shall mean the Contractor.

2) Paragraph 3.1.1: Add to the end of the sentence the words "unless otherwise noted."

3) Paragraph 3.3 Discrepancies: Delete and replace the first sentence with the following: "In case of discrepancies in the plans and specifications or between the two, the more restrictive shall govern unless otherwise agreed upon by the Engineer. Notify the Engineer of any discrepancies. In case of discrepancies between scaled dimensions on the plans and figures written on them, the figures shall govern."

4) Paragraph 4.1 Owner Responsibility: Delete this paragraph and replace with the following: "Paragraph 4.1 Contractor's Responsibility - The Contractor is responsible for supplying the fabricator and erector with all Drawings and

Specifications in order that they may proceed properly and expeditiously with the Work.

5) Paragraph 4.4 Approval: Delete the second, third, and fourth sentence in their entirety and replace with “If shop drawings are marked “approved” or “Approved as noted, no resubmission required”, the fabricator makes the corrections, furnishes the corrected prints, and is released by the RIOC to start fabrication.

6) Paragraph 4.4.2: Delete the paragraph in its entirety.

7) Paragraph 4.5: Delete the paragraph in its entirety.

8) Paragraph 9.1.1: Remove the word "completely".

b. AISC 360 as modified by the 2014 NYC Building Code.

c. Seismic Provisions for Structural Steel Buildings AISC 341-05.

d. "Specifications for Structural Joints using ASTM A325 or A490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation (RCRBSJ) – AISC-2000.

e. "Structural Welding Code" - AWS.

4. Recommendations or suggestions in the codes and references listed in this Article and under “References” shall be deemed to be mandatory unless they are in violation of the Building Code.

C. Certifications

1. Structural steel shall conform to the material acceptance, certification, and inspection requirements of Section BC 1701.

2. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the site at such intervals as to insure uninterrupted progress of Work.

B. Deliver anchor bolts and other anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time so as not to delay Work.

C. Store materials to permit easy access for inspection and identification.

1. Shop-primed steel. (Painted or galvanized): Primed steel stored in the field or shop shall be kept off ground (using pallets, platforms, or other supports) and so positioned as to minimize water-holding pockets, dust, and other contamination of the primer. Repair damage to primed surfaces due to improper storage in a manner approved by the RIOC.

2. Unpainted Steel: Steel stored in field or shop shall be kept off ground (using pallets, platforms or other supports), kept clean and in general protected against damage and corrosion.

D. Do not store materials on erected structure in a manner that might cause distortion or damage to the members or supporting structures. Repair or replace damaged materials or structures as directed by the RIOC.

1.10 FIELD MEASUREMENTS

A. Take field measurements as required by Drawings. Where possible take field measurements of existing conditions prior to fabrication. Verify that field measurements are the same as those shown on Drawings and shop drawings. Report all deviations to the RIOC in writing.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Stud Shear Connectors

1. Nelson Stud Welding Co.

2. Tru-Weld/Tru-Fit Products Corporation

3. Hilti, Inc.

B. Paint

1. Tnemec Co.

2. Carboline

3. Sherwin Williams

4. ZRC

C. Expansion/Screw/Adhesive Anchors, Fasteners

1. Hilti, Inc.

2. ITW Buildex/Red Head/Ramset

3. Simpson Strong-Tie Anchor System

4. Powers Fasteners

D. Zinc Metallizing

1. Atlantic Coast Metallizing & Coatings Corp., Melville, NY

2. East Coast Metallizing & Coating Systems Inc., Westbury, NY

3. Island Wide Sandblasting Inc., Wyandanch, NY

4. Reneuxit LLC, West Chester, PA

5. Avant Guards Manufacturing, Brooklyn, NY

E. Hot Dip Galvanizing with Powder Coating Finish

Duncan Galvanizing Corp., Everett, MA

2.2 MATERIAL

A. Structural Steel Shapes, Plates, and Bars

1. Structural steel W shapes shall have a minimum yield strength of 50 ksi conforming to the provisions of ASTM A992. For other shapes not available in ASTM A992, steel shall have a minimum yield strength of 36 ksi conforming to the provisions of ASTM A36.

2. Tube steel shall conform to the provisions of ASTM A500, Grade B, and pipe steel to the provisions of ASTM A53, Grade B.

3. Structural steel shall contain a minimum of 30% post consumer content and 15% pre-consumer content.

B. Headed Stud-Type Shear Connectors

1. Shall conform to the provisions of ASTM A108, meeting chemical requirements of ASTM A29, Grade 1010 through 1020, and Article 7.2.6 of AWS D1.1. Welded studs shown on the Drawing are the Basis of Design.

2. Mechanical Studs of equivalent strength to welded studs. Unless shown on the Contract Drawings, the size, number of and location on the beam shall be in accordance with the manufacturer's published data and supported by test data.

a. Mechanical shear connectors shall be Hilti X-HVB Shear Connectors installed with Hilti X-ENP-21 HVB powder-actuated fasteners.

C. Bolts

1. Anchor Bolts (Anchor Rods): Shall conform to the provisions of ASTM F1554, Grade 36, unless different grade is specified elsewhere. Size and detailing indicated on Drawings.

2. Unfinished Bolts: Shall conform to the provision of ASTM A307.

3. High-Strength Bolts: Shall conform to the requirements of ASTM A325 or F1852 unless otherwise indicated on Drawings.

4. Expansion/Screw/Adhesive Anchors: Provide types as indicated on Drawings. The anchor specified shall be considered the basis of design.

   a. As a minimum, all anchors exposed to weather or embedded in masonry are to be Type 316 stainless steel.
   b. Anchors installed in concrete shall have current ICC-ES listing for performance in cracked concrete as per Section BC 1912.
      1) Wedge Expansion and Undercut Anchors/ expansion bolts shall have an ICC-ES Evaluation Service Report (ESR) issued in accordance with ACI 355.2 or ICC-ES AC 193 for use in cracked concrete, including seismic applicability loading, and pursuant to the Office of Technical Certification and Research (OTCR) Building Bulletin 2014-018. Anchors installed in grouted masonry shall have a report issued in accordance with AC 01.
      2) Adhesive anchors in concrete shall have an ICC-ES Evaluation Service report (ESR) issued in accordance with ACI 355.4 or ICC-ES AC 308 for use in cracked concrete, including seismic applicability loading, and pursuant to the Office of Technical Certification and Research (OTCR) Building Bulletin 2014-018. Anchors installed in grouted masonry shall have a report issued in accordance with AC 58.
      3) Concrete Screw Anchors shall have an ICC-ES Evaluation Service report (ESR) issued in accordance with ICC-ES AC193 for use in cracked concrete and seismic loading and pursuant to the Office of Technical Certification and Research (OTCR) Building Bulletin 2014-019. Anchors installed in grouted masonry shall have a report issued in accordance with AC 106.
   c. Design and installation provisions shall be based on current ICC- ES ESR report and ACI 318 Appendix D.

D. Hardware

1. Nuts for anchor bolts and unfinished bolts shall conform to the requirements of ASTM A563.

2. Nuts for high-strength bolts shall conform to the provisions of ASTM A194 or ASTM A563.

3. Washers shall conform to the provisions of ASTM F436.

E. Filler Metal for Welding

1. Welding electrode shall conform to E70XX classi- fication of AWS A5.1, except as described below.

2. Welding electrode shall be compatible with existing steel where connections are made to steel of existing building. Electrode shall be E7018 unless determined otherwise. E7018 are low hydrogen electrodes that must be kept extremely dry.

F. Structural Steel Primer Paint

Provide type of primer indicated on steel under the following application conditions.

1. General application: Acrylic rust-inhibitive type containing no lead equal to Tnemec 115 Unibond or Carboline Carbocrylic 3358. Paint must meet SCAQMD standards for VOC emissions.

2. Cavity wall (including steel within the exterior block back-up or not separated from the cavity by a full block), exterior application, and as a primer after zinc metallizing: Epoxy paint equal to Tnemec Co. Series FC27 Typoxy or Carboline Carboguard 888.

3. Touch-up primer for cavity wall and exterior application: High adhesion high-solids epoxy coating equal to Tnemec Co. Series 135 Chembuild or Carboline Carboguard.

G. Galvanizing by the Hot-dip Method – No Finish Coating

1. Galvanize structural shapes in accordance with ASTM 123.

2. Galvanize hardware in accordance with ASTM A153.

3. Galvanizing repair paint for regalvanizing welds and damaged areas shall conform to ASTM A780 and comply with Military Specification MIL-P-21035, such as ZRC Cold Galvanizing Compound.

H. Galvanizing by the Zinc Metallizing Process or Hot-Dip Galvanizing; and Finish Coating

1. Zinc/aluminum metallizing (referred to herein as zinc metallizing) is the process of thermally applying an 85/15 zinc-aluminum wire over the surface of steel.

2. Zinc metallizing, or hot dip galvanizing, and finish coating system shall have the following performance characteristics and results of tests performed on representative samples. Finish coating for metallizing shall have an epoxy coating system or powder coating. Finish coating for hot

dip galvanizing shall be powder coating (See paragraph 3 below for acceptable system):

a. Adhesion: Test zinc metallizing/hot dip galvanizing with complete finish coating (epoxy coating system or powder coating system) in accordance with ASTM D4541, Test Method E. Pull-off strength throughout the system shall be not less than 750 psi before and after environmental cycling.
Environmental cycling shall be 10 cycles of the following: 4 hrs at 100% humidity per ASTM D1735; 16 hours below 0°F; and 4 hours at 140°F.

b. Corrosion resistance of zinc metallizing/hot dip galvanizing with epoxy coat system or powder coating: A rating of 10 after 1000 hours salt fog (prohesion method) when tested in accordance with ASTM D1654, Procedure A. Scribe shall be cut through all coatings to bare steel substrate. Expose specimens in accordance with ASTM G85.

c. Powder coating complying with the following ASTM standards:
Adhesion: ASTM D3359, no loss.
Hardness: ASTM D3363 (pencil), H min.
Falling Sand: ASTM D968 20L/mil.
Salt Spray: ASTM B117, passes 3000 hrs.
Humidity: ASTM D2247, 3000 hours, few #8 blisters.
Impact Resistance (3mm): ASTM D2794, no loss.
Color Retention: ASTM D2244, 5 year less than or equal to 5 delta E.
Chalk Resistance: ASTM D4214, #8 rating.
Gloss Retention: ASTM D523, greater than or equal to 30 percent retention.
Erosion Resistance: ASTM B244, less than 10 percent film loss.
Compliance: AAMA 2604.

3. Hot Dip Galvanizing with Powder Coating Finish

a. As a system equivalent to zinc metallizing, it is permitted to use the Duncan Colorgalv Thermoset process of hot dip galvanizing with powder coat finish. Galvanizing coating thickness grade per ASTM A123 shall be 100, with DFT mil thickness coating not less than 3.6 to 3.9 mils.

b. Powder coating thickness shall be as specified in this specification. Coating shall include an architectural grade primer.

4. Galvanizing repair paint for regalvanizing welds and damaged areas shall conform to ASTM A780 and comply with Military Specification MIL-P-21035, such as ZRC Cold Galvanizing Compound.

2.3 SHOP ASSEMBLY - FABRICATION

A. General

1. Do not fabricate until shop drawings have been approved.

2. Fabricate and assemble steel in shop to greatest extent possible. Fabricate items and assemblies in accordance with AISC Specifications and the shop drawings.

3. Properly mark members for field assembly. Fabricate items in order to match delivery sequence that will expedite erection.

4. Mill column ends at base plates, cap plates, and splices to a common plane by means of an approved milling machine.

B. Shop Connections

1. Weld or high-strength bolt shop connections as indicated on Drawings.

2. High-strength bolt connections are friction (slip-critical) connections. Install high-strength bolts in accordance with "Specification for Structural Joints using ASTM A325 or A490 Bolts" (RCRBSJ). Utilize Class A connections. If steel surface of connection area is prepared to SSPC-SP5 surface preparation, Class B may be utilized pending inspection by the RIOC's Special Inspection lab that surface meets the required preparation. Pay all costs to the RIOC incurred for this inspection.

3. Welding: Comply with "Structural Welding Code" for procedures, appearance, and quality of welds and methods used in correcting welded work.

4. Holes for other Work

a. Provide holes and openings required for securing other Work to steel framing and for passage of other Work through framing members. Coordinate with Drawings of other Work.
b. Provide threaded nuts welded to framing, and other specialty items as indicated to receive other Work.
c. Cut, drill, flame cut, or punch holes perpendicular to metal surfaces. Method of cutting must not produce a roughness of over 1000 microinches. Surfaces exceeding these limits must be repaired by machine grinding.
d. Reinforce all openings with steel shapes as shown on shop drawings.

C. Shear Stud Connectors (Non-Metal Deck Construction)

1. Weld shear studs to beams with automatically timed stud welding equipment at spacing shown on Drawings. Size, type, and length specified on Drawings.

2. Top flanges of beams must be free of paint, heavy rust, mill scale, dirt, ice and/or water, and any other material that will interfere with the welding operation.

2.4 SHOP PAINTING

A. General

Apply one shop coat of primer paint on structural steel except as follows:

1. Structural steel that is encased in concrete.

2. Steelwork or portions of such to receive sprayed fireproofing. Steel that is exposed to the cavity and within the block back-up is to be painted, unless indicated to be galvanized.

3. Top flanges of structural steel members requiring stud shear connectors or supporting metal deck.

4. Contact surfaces of structural steel that are to be bolted or welded together.

5. Surfaces of structural steel within 2" of field welds.

6. Contact milled bearing surfaces.

7. Steel members, hardware, and miscellaneous pieces to be galvanized and not specified or indicated to be painted.

B. Cleaning and Surface Preparation

1. Clean all steel first in accordance with SSPC-SP1.

2. Clean steelwork not to be painted (except steel work to be galvanized) in accordance with SSPC-SP2.

3. Clean steelwork to be painted within the same day as it will be applied and in accordance with the following methods, determined by location and exposure:

a.	Interior steel not exposed to view:	SSPC-SP2.
b.	Interior steel exposed to view:	SSPC-SP3.
c.	Cavity wall and exterior steel exposed to weather:	SSPC-SP6.

C. Shop Coat

1. Apply structural steel primer paint (general application) at a rate to provide dry film thickness of 2.0 to 3.5 mils. Apply primer paint (cavity wall and exterior application) at a rate to provide dry film thickness of 4.0 to 6.0 mils. Provide full coverage of joints, corners, edges, and exposed surfaces.

2. Apply to dry surfaces only, when surface temperatures are above dew-point, by brush, spray, or roller, thoroughly and evenly, in strict accord with manufacturer's instructions for every detail of handling.

3. Apply second coat of the approved primer, in a darker shade, to surfaces inaccessible to painting after assembly or erection.

4. Protect machined surfaces with an approved rust-inhibiting coating that is readily removable prior to erection.

D. Concrete Contact Surfaces

Paint steelwork at least two inches into the area in contact with concrete, where applicable.

2.5 GALVANIZING

A. General

Galvanize the following members:

1. All angles supporting exterior masonry or exposed to the weather, including shelf, arch, relieving angles.

2. All connections between the above angles and the supporting structural member, including WT's, hangers, clip angles, hardware, etc.

3. All exterior steel supporting mechanical equipment (dunnage steel) and any other steel members indicated on Drawings.

B. Cleaning and Surface Preparation

1. Hardware (bolts, nuts, etc.): Clean and leave free of mill scale before galvanizing.

2. Clean all steel first in accordance with SSPC-SP1 if needed.

3. Steel members: Clean in accordance with SSPC-SP8 before hot-dip galvanizing.

4. Steel members: Clean in accordance with SSPC-SP10 before zinc metallizing. Surface shall have a 3-4 mil anchor pattern. Moisture cannot

be present on steel and temperature cannot be less than 5°F above the dew point. Thermal spray must be applied within 4 hours of blasting.

C. Shop Coat - Hot-dip Galvanizing Only – Provide for galvanized items not to have finish paint coat.

1. Galvanize hardware in accordance with ASTM A153.

2. Galvanize steel shapes in accordance with ASTM A123. Apply zinc coating as per Thickness Grade specified in ASTM A123.

D. Shop Coat – Galvanizing by the Zinc Metallizing Process – Provide for all galvanized items indicated to receive finish paint, which includes all galvanized items exposed to public view and other items shown on Drawings or specified herein. Finish paint shall be the epoxy coat system or the powder coat system; producing a smooth, uniform surface, free of bubbles, runs, or sags. Hot Dip Galvanizing with powder coat finish is also permitted as specified in Paragraph E below.

1. Thermally spray metallizing material at a rate of 4.0 to 6.0 mils DFT. Sprayed coating shall be free of lumps, blisters, and loosely adhering particles. Coating shall be capable of passing the inspection requirements of Mil Std 2138A(SH) of 5/13/92, but with adhesion 750 psi minimum per ASTM D4541, Test Method E.

2. Epoxy Coating System, as specified in Section 09900: After the metallizing material has cured, apply a first coat of paint at a rate of 4.0 to 6.0 mils DFT, Polyamide Epoxy Paint such as Tnemec Series 27 FC Typoxy. Top coat shall be Acrylic Aliphatic Polyurethane such as Tnemec Series 73 Endura-Shield, applied at a rate of 2.0 to 3.0 Mils DFT.

3. Powder Coating System: After the metallizing material has cured, properly prepare the item and apply Tiger Drylac Series 38 Super Durable Powder Coating; or PPG Industries Coraflon Ultradurable Powder Coating; or Sherwin-Williams Powdura Super Durable Powder Coatings Series system.

   a. Oven bake item for 20 minutes at 450°F, and remove all oil and grease. Cool surface to 72°F, clean with an organic solvent. Apply paint within 3 hours of final cleaning.
   b. Apply an out-gas-forgiving primer at the rate of 2-3 mils DFT. Oven cure material at 400°F for 10 minutes.
   c. In order to avoid oxidation, final topcoat must be applied within 12 hours.
   d. Apply a lead-free TGIC polyester powder topcoat finish at a rate of 4.0 to 5.0 mils DFT.
   e. Oven cure at 400°F to 450°F, for 30 minutes, or as recommended by coating manufacturer.

E. Hot Dip Galvanizing with Powder Coating Finish

As a system equivalent to zinc metallizing, it is permitted to use the Duncan Colorgalv Thermoset process of hot dip galvanizing with powder coat finish. Galvanizing coating thickness grade per ASTM A123 shall be 100, with DFT mil thickness coating not less than 3.6 to 3.9 mils.

1. Comply with ASTM A123 for fabricated products and ASTM A153 for hardware, with zinc coating thicknesses not less than those specified in this specification Section 05700, 3.6 to 3.9 mils DFT.

2. Fill vent holes after galvanizing, if applicable, and grind smooth.

3. Galvanizing shall exhibit a rugosity (smoothness) 4 rug or less (16-20 microns of variation) when measured by a profilometer over a 1 inch straight line on the surface of elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1 micron increments.

3. The incoming material shall be inspected, material hung on a rack or chain to be galvanized.

4. Material submerged into caustic cleaner removing the organics from the surface and rinsed with water.

5. Material pickled with hydraulic acid removing iron oxides from the surface and rinsed with water.

6. Material submerged into a flux removing any oxides that have formed after pickling and protecting the material from further formation of additional oxides before being galvanized.

7. The material submerged into Zinc bath at 850°F.

8. The material shall be allowed to naturally cool and not quenched with water or chemicals.

9. The galvanizing shall be inspected and pre-finished, removing edge tears, spikes, drips, or sharp protrusions which could cause potential harm to someone handling or using the material.

10. The Galvanized material shall be abraded to create a 1-1.5 mil profile for surface preparation. The profile shall be produced by abrasive blasting and or hand abrading.

11. The galvanized material shall be inspected prior to powder coating to determine conformance of the material to ASTM A123 and this specification Section 05700 for quality and thickness of zinc coating, not less than 3.6 to 3.9 mils DFT.

12. The galvanized surface profile shall be measured at

13. 1-1.5 mils and recorded utilizing Press-O-Film tape.

14. All galvanized material shall be outgassed after profiling and before powder coat application.

15. A coating inspection form shall be filled out completely with material information, application conditions, and quality standards.

16. All powder coating products shall be electrostatically applied following the recommendations of the powder supplier and the requirements of the powder coating Manufacturers Technical Data Sheet, and with Dry Film Thickness not less than is specified in this specification Section 05700.

17. The first coat shall consist of an Epoxy Primer powder applied at not less than 2.0 – 3.0 mils Dry Film Thickness. The powder shall be heated to 400°F to provide adhesion with the next coat of powder, and in accordance with the manufacturer's recommendations.

18. The next coat of powder to be applied shall be Sherwin Williams Powdura Super Durable or approved equal applied at a dry film thickness of not less than 4.0-5.0 mils. The surface of the fabrications after applying the powder shall be heated to 400°F for at least 10 minutes to cure the powder and in accordance with the manufacturer's recommendations. The color of the powder shall match the approved color sample that will be approved by the Project Architect.

19. All repairs of galvanizing shall follow ASTM A780.

20. All repairs to powder coating shall be sanded and feathered with the surrounding area. The damaged area shall be cleaned and abraded to receive a powder or liquid coating. The liquid coating can be applied using either a spray or brush method.

21. Apply powder coating system within time frame after galvanizing as part of the Duncan Colorgalv process to ensure oxides will not form and GoldGalvthermoset process will be complete.

2.6 SOURCE QUALITY CONTROL

A. Testing

1. General

   a. Structural steel work is subject to all tests required by the Special Inspection requirements of the 2014 NYC Building Code.
   b. Cooperate with the Testing Laboratory in making all required tests.

2. Tests: To be performed by the RIOC's Testing Laboratory.

a. Shop bolted connections: Tested in accordance with AISC specifications.
b. Shop welding: The laboratory will perform the following functions:
   1) Certify welders.
   2) Visually inspect all welds, record type and locations of defects, and perform tests if necessary. Check all corrected work.
   3) Perform following non-destructive tests if necessary or as required by the Special Inspector. Tests used shall be at the Special Inspector's option:
      a) Liquid Penetrant Inspection: ASTM E165.
      b) Magnetic Particle Inspection: ASTM E709. Perform on roof pass and on finished weld.
      c) Radiographic Inspection: ASTM E94 or E149. Minimum quality level 2-2T.
      d) Ultrasonic Inspection: ASTM E164.

3. Welding of Critical Joints

a. All welded joints that are critical to the integrity of the structure, and require non-destructive testing to assure the adequacy of the critical weld, are indicated on the Drawings.
b. To insure general weld quality of less critical groove and butt welds, a quality control program may be required to check the welds by non-destructive testing. The Drawings specify whether non-destructive testing is required and, if necessary, the method of inspection.
c. Requirements of critical welds and non-destructive testing shall be in conformance with NYC BSA Rules for Arc and Gas Welding, Rules 16.5 through 16.5.3, and Rule 17.

B. Inspection

1. Testing Laboratory

a. The RIOC will engage a Testing Laboratory or Special Inspection Agency to assist in the inspection of steel fabrication and conduct tests at the mill, shop, or foundry. The laboratory will assist in checking erection tolerances and provide shop and field testing required for all structural steel work, including metal deck and studs.
b. The Testing Laboratory will be responsible to and under the supervision of a Special Inspector.

2. Special Inspector

The RIOC will assign, under the requirements of Section BC 1704.3, a Special Inspector to supervise the Work listed above under "Testing Laboratory".

3. Notification: Notify the RIOC before beginning fabrication of the structural steel and supply laboratory with copies of agreements, approved drawings, approved prints of all shop details, etc., and all necessary information relating thereto. Do not ship material to job site until after inspection and approval by the Testing Laboratory.

4. Discretionary Inspections: No mill, shop, foundry, or field inspection, such as is above provided for, shall be held to prohibit or preclude inspection of such materials during delivery and erection at the building by such other persons as the RIOC shall direct.

5. Reports: Shop and field reports, including shipments, will be submitted by the Testing Laboratory to the RIOC as the work proceeds at the shop or job site. A final report will be submitted by the Testing Laboratory when work is completed at the shop, and again when work is completed in the field. The Special Inspector reserves right to reject material not in compliance with specified requirements at any time.

6. Corrections: Correct deficiencies in work which inspections and tests have indicated to not be in compliance with requirements. Pay for additional tests, at own expense, necessary to reconfirm any non-compliance of original work and as necessary to show compliance of corrected work.

7. Contractor's Responsibility: Inspection and acceptance or failure to inspect shall in no way relieve the Contractor or the mill and shops from their responsibility to furnish satisfactory material strictly in accordance with Drawings and Specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and that erection may proceed. Notify the RIOC in writing of conditions that adversely affect the Work. Do not proceed with erection until conditions have been corrected. Beginning of installation means the erector accepts existing conditions.

3.2 ERECTION

A. General

1. Erection shall conform to Sections BC 2205.6.3 and BC 3305.2.

2. All work shall be erected plumb, square, and true to lines and levels in strict accordance with the structural requirements of the building.

3. Provide all machinery, apparatus, and staging required for the erection of steelwork in a thoroughly safe and efficient manner. Install, maintain and remove, without injury to other Work, such temporary bracing, scaffolding, etc. as may be necessary or required. Care shall be taken that no part of the structure is overloaded during construction.

4. Arrange for deliveries of material to facilitate the rapid and continuous progress of operation, but the site or streets adjacent to same shall not be used for the storage of material unless absolutely necessary and then only with special permission of the RIOC and other authorities having jurisdiction.

5. Employ a Licensed Professional Engineer and Land Surveyor to ensure accurate erection of the steel.

6. Do not alter or cut structural members without written approval of the Engineer of Record.

B. Temporary Shoring and Bracing

Provide temporary shoring and bracing members with connections of sufficient strength to bear erection loads and guy wires to maintain structure plumb and in true alignment until completion of erection. Remove temporary work when permanent members and bracing are in place and final connections are made.

C. Anchors Bolts

1. Furnish to the concrete and brick masons anchor bolts and other connectors required for securing structural steel to the foundation and other in-place concrete work, together with instructions, templates, etc. necessary for setting them. Anchor bolts are to be surveyed and any approved modifications made prior to placement of columns.

2. Tighten anchor bolts after support members have been positioned and plumbed. Cut off protruding edges of wedges or shims flush with edge of base or bearing plate prior to packing with grout.

D. Base and Bearing Plates

1. Clean concrete and masonry bearing surfaces of loose and bond-reducing materials.

2. Set loose and attached base plates and bearing plates for structural members on shims and other adjusting devices, such as leveling plates, within specified tolerances. Elevations of shims and leveling plates shall be surveyed and adjusted to correct elevation prior to placement of column or beam. Plates are to have grout holes.

3. Grouting under plates is part of the Work of Section 03610. Grouting is to be done prior to placement of any concrete on the structure.

E. Field Assembly

1. Erect structural frames accurately to lines and elevations indicated. Align and adjust members forming a part of a complete frame or structure before permanently fastening.

2. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly.

3. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

4. Level and plumb individual members of the structure within specified tolerances. Do not tighten structure until surveys verify that structure is within allowable tolerances.

5. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.

6. Splice members only where indicated and accepted on shop drawings.

F. Connections

1. Field connections shall be welded or bolted, except where welding is specifically called for on the Drawing.

   a. Provide high-strength bolts for bolted connections except where unfinished bolts are indicated on the Drawings. High-strength bolt connections are friction (slip-critical) connections. Install high-strength bolts in accordance with "Specification for Structural Joints using ASTM A325 or A490 Bolts."
   b. Provide unfinished bolts where indicated on Drawings. Lock nuts by upsetting bolt end or by similar method when unfinished bolts are not encased in concrete. Tighten all bolts and nuts fully.
   c. For ASTM A307 bolts, hardened washer shall be installed under the turned element. For ASTM A325, F1852, A490 and F2280 bolts, hardened washer shall be installed under the head and nut. This washer is not required under the head for oversized or short-slotted holes for bolts conforming to F1852 bolts (from 1/2" to 1½" in diameter) and for bolts conforming to F2280 bolts when the bolt diameter is < 1".
   d. Expansion/screw/adhesive anchors shall be installed in accordance with the manufacturer's installation instructions. Holes shall be cleaned completely using wire brush and compressed air following manufacturer's guidelines. Tighten to the torque values specified by the manufacturer. For installation in existing substrates not installed as part of the Work, have bolt

manufacturer perform pullout test in each substrate to verify capacity and quality of substrate prior to final approval of anchor to be utilized.

2. Holes

a. The size of boltholes shall be in accordance with AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings."

b. Ream holes that must be enlarged to admit bolts. Burning or use of drift pins is not permitted.

G. Erection Holes

Fill erection bolt holes on exposed to view members with plug welds and grind smooth.

H. Lintels and Relieving Angles

1. Erect all exterior steel lintels and relieving angles connected (by hangers, clips, bolts or otherwise) to the structural steel work.

2. Loose lintels (interior and exterior) and lintels secured to concrete are part of the Work Section 05700.

I. Flame Cutting

Flame cutting in field of members to correct fabrication errors is to be avoided and to be done only upon approval of the Engineer of Record based on the method proposed. Roughness cannot exceed 1000 microinches. Repair of surfaces shall be by mechanical grinding.

J. Field Touch-Up

1. Painted Members: After erection, clean all damaged areas in shop coat, exposed surfaces of bolts, bolt heads, nuts and washers, abrasions, and all field welds and unpainted areas adjacent to field welds to the same standards as the shop coat and paint with primer paint to same thickness as the shop coat. Finish painting is specified in Section 09900.

2. Galvanized Members: After erection, clean and paint all damaged areas to the galvanizing, welds, and areas adjacent to welds with the galvanizing repair paint. For galvanized members to be painted, finish painting is specified in Section 09900 and shall be the final two coats of the epoxy paint system.

3.3 TOLERANCES

A. Erection tolerances shall be in accordance with "Code of Standard Practice for Steel Buildings and Bridges", except as indicated in B below.

B. The following overall maximum deviations (tolerances) from theoretical are permitted:

1. Column location @ base plate: 1/2"

2. Base Plate, bearing plate and column splice elevation: +1/8”

3. Column Plumbness: in or out 3/4” in column length, 1¼” for total building height

4. Beam or girder elevation: +1/2”

5. Beam camber: 1/8”

6. Lintel elevation: +1/16”
Lintel location: +1/4”

3.4 FIELD QUALITY CONTROL

A. The Contractor shall cooperate with the Special Inspector and the Testing Laboratory performing Special Inspection testing by providing adequate notification for when work is performed that will require the inspection and provide all required access and means for the laboratory to perform the inspection and testing.

B. As per Section BC 1704.3, the Special Inspector will inspect erection of the structural framework and test field bolting and welding as listed in Part 2 of this Section. The Special Inspector will also check the welding of deck and metal studs described in Section 05300. Where post-installed anchors are utilized, the Special Inspector will perform Special Inspection on post-installed anchors as per Section BC 1704.32. Adhesive anchors installed in concrete in a horizontal or upwardly inclined position supporting sustained tension loads shall be installed under continuous Special Inspection as required by paragraph D9.2.4 of ACI 318-11.

C. The Contractor shall engage an engineer licensed in the state of New York to check tolerances and inspect the erection.

D. Contractor’s Surveys

Provide surveys of items listed below. Surveys are to indicate the actual location and elevation and the deviation from theoretical. Highlight those numbers that exceed permissible tolerances. Surveys are to be submitted in a timely manner in order for corrections to be made prior to installation of the next item in

sequence (e.g. anchor bolt and base plate survey prior to column installation), including placement of concrete. The following items are to be surveyed:

1. Anchor bolt location

2. Elevation of bottom of base plates (top of shims or leveling plate).

3. Elevation of lowest column splice.

4. Location (x,y, & radial) and plumbness of columns.

5. Elevation of steel members taken at approximately 20 members from each floor for those members not cambered.

6. Elevations of cambered members taken at each end and in center. The average of the two ends subtracted from the center will be the measured camber. Approximately 20 members will be selected by the Engineer of Record to be surveyed. Survey is to be done prior to and after placing concrete.

7. Elevation and location of lintels prior to installation of masonry.

3.5 CLEANING

A. Structural steel or portions of such to receive sprayed fireproofing shall be clean of dust, grease, oils, loose material, and any other matter which would impair the adhesion of the fireproofing material to the steel.

END OF SECTION 051200

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SECTION 051700 - SUPPORT SYSTEM FOR SUSPENDED CEILINGS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide structural ceiling suspension system as indicated on the Drawings and as specified herein, for all suspended ceiling systems.

B. This suspension system shall include the attachment to overhead concrete slab/concrete metal deck slab assembly, steel angle, plate hanger, and running (carrying) channels.

C. Optional Method (to that in Par. B., above): Use steel eyelet in lieu of steel angle.

D. Provide supports for furred areas, and for opening frames, lighting fixtures, furred ceilings, hoods and other items.

E. Furring members and other attachments for the various ceiling materials and systems shall be as specified in the respective Section.

F. For metal panel ceiling systems in which the weight of the acoustical ceiling panels does not exceed 4 lbs/sq. ft., the GAT suspension system meeting the requirements of the NYC Building Code, Reference Standard RS 5-16 of the 1968 Code and Appendix R of the 2014 Code, may be used as specified herein. Anchorage to supports to be per the code and this specification.

G. Refer to ASCE 7-10, Section 13.5.6 and ASTM E580 for seismic requirements. For ceilings in buildings of Seismic Design Category D (refer to structural drawings for building designation), provide seismic sway bracing at required spacing for all ceiling components for ceilings greater than 1000 SF in area.

1.2 REFERENCES

A. References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

B. American Society for Testing and Materials (ASTM)

A36 Specification for Structural Steel

A307 Specification for low Carbon Steel Externally Threaded Standard Fasteners

A446 Standard Specifications for Steel sheet, Zinc-Coated by the Hot-Dip Process, Structural Quality

A525 Standard Spec. for General Requirements for Steel Sheet, Zinc-Coated by the Hot-dip Process

A568 Standard Spec. for Steel, Sheet, Carbon, and High Strength, Low-alloy, Hot-rolled and Cold-rolled, General Requirements for

C635 Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings (As modified by Appendix R of the 2014 NYC Building Code)

C636 Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels (As modified by Appendix R of the 2014 NYC Building Code)

E580 Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions

1.3 SUBMITTALS

A. Submit product data for all components, connections and anchorages.

B. Submit Shop Drawings showing suspension assembly, indicating all components, connections and anchorages.

C. Submit three (3) samples of each component of the assembly.

D. Submit sample of anchor and descriptive literature indicating its characteristics; submit laboratory report certifying pullout and shear capabilities for the anchor embedded in the materials to be used in this Project.

E. “Coordination Drawings” per Part 3 of this Specification Section.

1.4 REGULATORY REQUIREMENTS

A. New York City Building Code.

B. New York City Board of Standards and Appeals (BSA) approval, New York City Materials Equipment Acceptance (MEA), Office of Technical Certification and Research (OTCR).

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hangers and Clips

1. Steel Angle and Plate Hanger

ASTM A36. Provide angle 3"x3"x3/16"x1" wide, with $1^3/_8$" long slot for 3/8" bolt. Provide plate hanger 1" wide x 1/8" minimum thickness, with $1^3/_8$" long slot for 3/8" bolt. Increase thickness of plate hanger where required to support all loads suspended therefrom plus an additional 200 pounds located at midspan between hangers. Provide galvanized units for kitchen ceilings, and painted units at other locations unless indicated otherwise.

2. Optional Method

Use steel eyelet with safe working load of 300 pounds, in lieu of steel angle. Attach eyelet to threaded stud sleeve anchor. Attach plate hanger to eyelet with 3/8" bolt. Provide plate hanger 1" wide x 1/8" minimum thickness. Increase thickness of plate hanger where required to support all loads suspended therefrom plus an additional 200 pounds located at midspan between hangers. Provide galvanized units for kitchen ceilings, and painted units at other locations unless indicated otherwise.

B. Bolts

ASTM A307, 3/8" diameter, with lock washers and nuts. Provide shop coat of paint.

C. Running (Carrying) Channels

Minimum dimensions: Cold rolled, $1^1/_2$" deep x 7/16" wide flanges; 0.44 lb/lf painted; and as indicated on the Drawings. Provide galvanized channels for kitchen ceilings. Provide shop painted channels at other locations unless indicated otherwise on the Drawings.

Increase size of channels where required such that midspan deflection, under all loads supported therefrom, shall not exceed 1/360 of the span, in accordance with the New York City Building Code. Loads shall include all ceiling materials, lighting fixtures, and other equipment and items supported by the channels.

ASTM A568 for painted channels.
ASTM A446 for galvanized channels: ASTM A525 - G60 galvanized coating.

D. Anchors (hanger assembly to metal deck construction) - Installed after deck and concrete in place:

1. Manufacturers

   a. Hilti Fastening Systems.

   b. ITW Buildex/Red Head/Ramset

   c. Simpson Strong-Tie Co., Inc.

   d. Powers Fasteners

2. Stainless Steel or Galvanized

3. Anchors

   a. Expansion/screw/adhesive anchors or powder actuated fastener of capacity indicated below in paragraph 4. Anchors installed in concrete shall have current ICC-ES listing for performance in cracked concrete as per Section BC 1912 of the 2014 NYC Building Code. Powder actuated fasteners shall not be permitted for use in Buildings in Seismic Design Category D as per Section 13.4.5 of ASCE 7-10. Refer to Structural Drawings for Seismic Design Category of building.

   b. Threaded stud anchors or internally threaded sleeve anchors of capacity indicated below in paragraph 4. Anchors installed in concrete shall have current ICC-ES listing for performance in cracked concrete as per Section BC 1912.

4. Safe working loads:

   a. Metal panel ceilings:

      1) Pullout: Safe working load of 300 lbs minimum.

      2) Shear: Safe working load of 250 lbs. minimum.

      3) Provide increased pullout capacity as required to ensure that each hanger is capable of carrying all loads suspended therefrom plus additional 200 pounds loads located at midspan of running channels. Provide 300 lbs (minimum) pullout and 300 lbs (minimum) shear for seismic sway bracing.

E. Hangers and clips for GAT system: Materials in accordance with NYC Building Code, Reference Standard RS 5-16 of the 1968 Code and Appendix R of the 2014 Code, including 1/4" minimum diameter galvanized steel rod hangers, and MEA/BSA/OTCR approved GAT clips with rated capacity for all supported loads plus 200 pounds minimum.

2.2 PAINTING

A. All steel members and accessories of the support system, unless specified to be galvanized or of stainless steel, shall be dipped or painted with one coat of acrylic rust-inhibitive type containing no lead equal to Tnemec 115 Unibond or Carboline Carbocrylic 3358. Paint must meet SCAQMD standards for VOC emissions.

PART 3 - EXECUTION

3.1 COORDINATION WITH OTHER TRADES

A. Coordinate this Work with the various trades who may have ducts, pipes, conduits, or other Work in the spaces above the suspended ceilings, in order that anchors, hangers and running channels may be properly placed to avoid such ducts, pipes, conduits, and other obstructions. Provide additional hangers and struts as needed to support ceiling due to interferences from ductwork etc. or due to selection of anchor that will provide equivalent capacity. Any changes required to be made in the locations of anchors, hangers, and running channels by reason of the Contractor's failure to observe this requirement shall be made by the Contractor without additional cost to the RIOC.

B. Coordinate Work with ceiling systems work.

C. Provide "Coordination Drawings" of all Work above suspended ceilings. Such "Coordination Drawings" shall overlay ceiling grids with all other Work above the ceiling so as to assure sufficient clearance for all building components in the ceiling cavity.

The "Coordination Drawings" shall be drawn at a scale of no less than 3/8" = 1'-0" and shall represent the coordinated Work of all the following building elements:

- Structure
- Ceiling construction
- Mechanical
- Electrical
- Plumbing
- Fire protection

3.2 SUPPORT SYSTEM LOCATIONS

A. Provide support system: for all suspended ceiling systems and for enclosures or furring systems indicated on the Drawings or specified herein.

3.3 INSTALLATION

A. Secure 3" x 3" steel angle to structural concrete deck/concrete metal deck assembly with approved anchors. Anchors/fasteners shall be installed in accordance with the manufacturer's installation instructions. For anchors, holes shall be cleaned completely using wire brush and compressed air following manufacturer's guidelines. To accommodate the running channel layout space anchors at 48" o.c. maximum in each direction, and as indicated on the Drawings. Utilize multiple fastener and increase size of clip if needed to meet conditions and minimum pullout requirements.

B. Attach steel plate hangers to angle with 3/8" diameter bolt, lock washer, and nut.

C. Attach running channels to plate hangers with 3/8" diameter bolt, lock washer and nut.

D. Install GAT suspension system in accordance with manufacturer's instructions. Use GAT clip to connect running channel to hanger rod.

E. Install channels level, true to grid layout, at proper height, ready to receive the ceiling system: furring members for lath and plaster or gypsum board; or for drop clips or direct attachment clips for acoustical ceiling tees. Provide type of clip required to maintain indicated ceiling height in coordination with clearances required for equipment above the ceiling.

F. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

3.4 CEILING OPENINGS

A. Provision shall be made for the installation of lighting fixtures, ventilating or air conditioning equipment, access openings, and other ceiling openings.

B. Rigid frames of furring members shall be provided around openings, adequately braced and reinforced.

END OF SECTION 051700

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SECTION 053100 - STEEL DECK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Furnish material, labor, equipment, services necessary to erect all metal deck, including connections, welding and accessories required for installation of Work. Field cut and fit deck as required and cut all openings.

B. Place edge of deck at proper location to ensure proper placement of masonry. Set deck edge from a survey line based on the theoretical building line.

1.2 RELATED SECTIONS

A. Structural Steel ..... Section 051200

B. Support Systems for Suspended Ceilings ..... Section 051700

1.3 SUSTAINABILITY REQUIREMENTS

A. Sustainability requirements included in the Section are as follows:

1. Documentation of material costs.

2. Documentation of regional materials.

B. The Contractor shall implement practices and procedures to meet the Project's sustainable requirements. The Contractor shall ensure that the requirements related to these goals, as defined in Specification Section S01352, Sustainability Requirements, and as specified in this Section, are implemented to the fullest extent. Substitutions or other changes to the work shall not be proposed by the Contractor or their sub-contractors if such changes compromise the stated Sustainable Design Performance Criteria.

1.4 REFERENCES

References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations,

suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

A. American Society Testing and Materials (ASTM) standards, latest editions.

A29 Standard Specification for Steel Bars, Carbon and Alloy, Hot-Wrought, General Requirements for

A36 Standard Specification for Carbon Structural Steel.

A108 Standard Specification for Steel Bars, Carbon, Cold-finished, Standard Quality.

A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

A780 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coating.

A992 Standard Specification for Steel for Structural Shapes for Use in Building Framing

B633 Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel

B. "Specification for Structural Steel Buildings" - American Institute of Steel Constructor's (AISC 360-05).

C. "Seismic Provisions for Structural Steel Buildings" (AISC 341-05).

D. "Structural Design of Composite Slabs" – American Society of Civil Engineers (ASCE 3-91).

E. "Standard for Non-Composite Steel Floor Deck" - Steel Deck Institute (ANSI/NC 1.0-06)

F. "Standard for Steel Floor Deck" – Steel Deck Institute (ANSI/RD 1.0-06).

G. Safety Requirements for Powder-Actuated Fastening Systems (ANSI A10.3), American National Standard (ANSI).

H. International Code Council Evaluation Service (ICC-ES):

1. International Building Code

2. Acceptance Criteria for Steel Deck Roof and Floor Systems (AC43)

3. Steel Deck Diaphragms (ESR-2199)

I. "Structural Welding Code - AWS D1.1" - American Welding Society (AWS).

J. "Specifications for Mild Steel Covered Arc - Welding Electrodes - AWS A5.1" - AWS.

K. "Diaphragm Design Manual for Floor Decks and Roof Decks" 3rd Edition - Steel Deck Institute (SDI).

L. "Fire Resistance Directory" - Underwriters Laboratory (UL).

1.5 DESIGN REQUIREMENTS

A. Design of metal deck is governed by Section BC 2209 of the 2014 NYC Building Code. Structural integrity requirements of the Section BC 2212.3 shall be met.

B. Metal deck unit sizes and gages are indicated on the Drawings.

C. Units shall be of three-span length except where framing layout does not permit. Deck sheets shall be butted over supports.

D. Provide shoring where required by the deck manufacturer as indicated on the approved shop drawings and where indicated on the Contract Documents.

E. Use of integral and non-piercing hanger tabs to support ceiling systems is not permitted. Piercing hanger tabs with a safe working loading of 250 lbs or greater are permitted for ceilings weights below the hanger tab capacity. Integral hanger tabs are to be used for venting purposes only.

F. Units included in a fire rated assembly must be classified in appropriate UL designs or have MEA, BSA, or OTCR approval.

G. Use fasteners or welds for decking attachment that provide adequate diaphragm shear strength, uplift resistance and stiffness for imposed load combinations.

H. Performance Requirements: FM classified Class I-90 minimum for uplift resistance and UL fire classified for roof deck.

1.6 SUBMITTALS

A. Product Data

Submit manufacturer's specifications for

1. Shear stud connectors

2. Deck Fasteners, if used

3. Primer Paint

B. Shop Drawings

1. Prepare metal deck shop drawings immediately after award of Contract.

2. Shop drawings shall include, but not be limited to the following:

   a. Type and gage of metal deck.
   b. Metal deck layout and orientation, including clear indication where shoring is required.
   c. Welding or fastener types, sizes and pattern.
   d. Side and end details of metal deck.
   e. Supplementary framing details.
   f. Location of all openings and fittings.
   g. Shop finish.
   h. Size, location, and spacing of stud shear connectors, where required, for each beam.
   i. Designation of welding electrode strength to be used.

3. Shop drawings reviewed by the Engineer of Record for general conformity with the Drawings shall not relieve the Contractor or the metal deck supplier of responsibility for correctness of fit, quantities of materials, and adequacy of attachment details of deck and accessories to the structural steel. Deck must have UL or OTCR approval as part of the fire rated assembly. Approval of shop drawings does not absolve the Contractor of this requirement. Coordinate with Section 07250 and 07260.

4. Calculations in accordance with ICC-ES AC 43 or SDI Design Method verifying diaphragm shear strength and stiffness: Submit calculations for the load tables of the metal deck supplied. Calculations shall be signed and sealed by a Professional Engineer licensed in the State of New York.

C. Quality Control Submittals

1. Certificates

   a. Submit notarized certificates from the manufacturers of the specified materials stating compliance with the applicable requirements set forth for all materials specified in this Section.
   b. Furnish steel manufacturer's certificate certifying welders employed on the Work have met AWS qualifications within the previous twelve months, and for work performed in the field are NYC licensed welders as per Section §28-407.1 of the NYC Administrative Code.

c. Furnish proof that deck to be used is part of a UL, MEA, BSA, or OTCR approved fire-rated assembly if other than deck shown on Drawings.
d. Submit certificate stating deck manufacturer is a member producer of SDI.

2. Manufacturers' Instructions: Furnish manufacturers' printed material, specifications and installation instructions for each type of decking, accessories, and studs.

3. Contractor Qualifications

Provide proof of Manufacturer, Erector, welder, and mechanical fastener technician qualifications specified under “Quality Assurance”.

D. Surveys

Submit signed and sealed copies of surveys conducted by a Licensed Land Surveyor showing locations of edge of deck with respect to theoretical edge of deck and building survey line.

E. Sustainability Submittals

1. Recycled Content

Submit Contractor’s Sustainable Materials Form for metal deck with complete materials cost information in accordance with Section S01352, Sustainability Requirements. This will be used to calculate default recycled content.

2. Regional Content

a. Submit documentation of regional materials for structural steel; product data or manufacturer’s statement as applicable
b. Submit Contractor’s Sustainable Materials Form with complete information on regional content for structural steel provided under this section in accordance with Section S01352, Sustainability Requirements. Include cost of materials and distance to point of materials extraction and manufacture.

1.7 QUALITY ASSURANCE

A. Qualifications

1. Manufacturer: Company specializing in the manufacture of metal deck as used in this Contract shall have a minimum of five years’ experience and is a member producer of SDI.

2. Erector: Company specializing in performing the Work of this Section shall have a minimum of three years' experience and have done at least three projects with similar quantity of material.

3. Welders: All steel roof deck welders shall be AWS certified for welding of sheet steel and NYC licensed.

4. Mechanical Fastener Installer: Shall be certified or licensed by the fastener and tool system manufacturer on the project site in accordance with ANSI A10.3 requirements. Certification or licensing includes all training necessary for proper tool operation, fastener selection, maintenance and troubleshooting.

B. Regulatory Requirements

1. Building Code: Work of this Section shall conform to all requirements of the NYC Building Code and all applicable regulations of other governmental authorities. Where more severe requirements than those contained in the Building Code are given in this Section, the requirements of this Section shall govern.

2. New York City Board of Standards and Appeals (BSA): Rules for Arc and Gas Welding and Oxygen Cutting and Steel Covering the Specifications for Design, Fabrication, and Inspection of Arc and Gas Welded Steel Structures and Qualification of Welders and Supervisors.

3. Industry Standards: Standards specified herein shall apply to Work of this Section. Where more severe requirements then those contained in the standards are given in this section or the Building Code, requirements of this Section or the Building Code shall govern.

   a. AISC 360-05 as modified by the 2014 NYC Building Code.
   b. Seismic Provisions for Structural Steel Buildings AISC 341-05.
   c. Section BC 2209 of the 2014 NYC Building Code
   d. Fire Resistance Directory - UL.

      1) Composite metal deck shall have UL approval with respect to the following:
         a) As a component part of a floor construction of specified fire resistance rating without need for sprayed fireproofing on underside of deck.
         b) As a component part of a three-hour fire resistive floor construction with use of sprayed fireproofing on underside of deck.
      2) Roof deck shall have UL approval as a component part of the specified fire resistive roof construction.

4. Recommendations or suggestions in the codes and references listed in this Article and under “References” shall be deemed to be mandatory unless they are in violation of the Building Code.

C. Certifications

1. Structural metal deck and stud shear connectors shall conform to the material acceptance, certification and inspection requirements of Section BC 1701.

2. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver deck to site undamaged. With each deck unit bearing the UL label and marking for specific system detailed.

B. Store deck units off the ground with one end elevated to provide drainage. Protect units from the elements with a waterproof covering.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Metal Deck and Accessories

1. CANAM Steel Corporation

2. Wheeling Corrugating Co.

3. Nucor, Vulcraft Group

B. Stud Shear Connectors

1. Nelson Stud Welding Co.

2. Tru-Weld/Tru-Fit Products Corporation

3. Hilti, Inc.

C. Mechanical Fasteners

1. Hilti, Inc.

2. ITW Buildex

D. Sidelap Connectors

1. Hilti, Inc.

2. ITW Buildex

3. Elco Textron

2.2 MATERIALS

A. Steel for Composite Metal Deck

1. Formed from galvanic steel sheets conforming to ASTM A653. Size of deck is to follow SDI requirements for thickness and tolerances.

2. Minimum yield strength of 33,000 psi.

3. Formed with integral locking lugs.

4. Formed with deformations to provide bond with concrete.

5. Deck to receive sprayed fireproofing shall be free of lubricants or oils that would impair the adhesion of the fireproofing material.

6. Metal deck that is not exposed to view with architectural paint finish shall have integral hanger tabs providing an approximate 0.5% uniformly distributed open area. The hanger tabs are used for venting purposes only.

B. Steel for Roof Deck

1. Formed from galvanic steel sheets conforming to ASTM A653. Size of deck is to follow SDI requirements for thickness and tolerances.

2. Minimum yield point of 33,000 psi.

3. Deck to receive sprayed fireproofing shall be free of lubricants or oils that would impair the adhesion of the fireproofing material.

C. Miscellaneous Steel Shapes

Shall conform to the requirements of ASTM A36 or A992. Members to receive sprayed fireproofing shall be unprimed and free of lubricants or oils that would impair the adhesion of the fireproofing material.

D. Shop Finish

1. Metal deck: Steel sheet shall receive before being formed a coating of zinc conforming to ASTM A653 coating class G60 (both sides). Metal deck exposed to view, such as in the gymnasium, shall be cleaned and phosphatized prior to priming. Primer shall be applied in the shop and shall be structural steel primer paint applied at a rate of 0.6 Mils DFT minimum). Salt spray resistance of paint shall be 100+ hours when tested in accordance with ASTM B117.

2. Steel roof deck: Steel sheet shall receive before being formed a coating of zinc conforming to ASTM A653 coating class G90 (both sides). Roof deck exposed to view, such as in the gymnasium, shall be cleaned and phosphatized prior to priming. Primer shall be applied in the shop and shall be structural steel primer or coil coating paint applied at a rate of 0.6 Mils DFT minimum). Salt spray resistance of paint shall be 100+ hours when tested in accordance with ASTM B117.

E. Metal Deck Accessories (cants, pour stops, closure pieces, etc.)

Shall conform to the requirements of ASTM A653, coating class G60. Unless a thicker gage is required by design considerations, such as at cantilever edge conditions, minimum thickness shall be same gage as metal deck. Accessories to receive sprayed fireproofing shall be free of lubricants and oils that would impair the adhesion of the fireproofing material.

F. Headed Stud Type Shear Connector

1. Shall conform to the provisions of ASTM A108, meeting chemical requirements of ASTM A29, Grade 1010 through 1020, and Article 7.2.6 of AWS D1.1. Welded studs shown on the Drawing are the Basis of Design.

2. Mechanical Studs of equivalent strength to welded studs. Unless shown on the Contract Drawings, the size, number of and location on the beam shall be in accordance with the manufacturer's published data and supported by test data.

   a. Mechanical shear connectors shall be Hilti X-HVB Shear Connectors installed with Hilti X-ENP-21 HVB powder-actuated fasteners.

G. Welds and Fasteners

1. Welds:

   a. Material: Welding electrodes shall conform to either E60XX or E70XX classification of AWS A5.1 as selected by the licensed

welder depending on the gauge of steel deck and strength of steel member being welded to and is subject to approval by the Engineer of Record.

b. Weld Washers: Use on steel roof deck thinner than 22 gauge

2. Mechanical Fasteners:

a. Material: AISI 1070 modified
b. Hardness: Minimum Rockwell Hardness C 54.5
c. Design and Manufacture: Knurled shank with forged ballistic point. Manufacturing process shall ensure steel ductility and prevent development of hydrogen embrittlement.
d. Washers:

1) For structural steel framing: Minimum 15 mm (0.591 in.) steel washers
2) For steel bar joist framing: Minimum 12 mm (0.472 in.) steel washers

e. Corrosion Resistance:

1) For steel roof decks with waterproofing membrane: 5 micron zinc electroplated in accordance with ASTM B 633 SC1 Type III
2) For exposed steel roof decks: Minimum AISI 304 stainless steel sealing caps with bonded neoprene washer shall be installed over each fastener

f. Design Requirements:

1) ICC-ES AC43 or SDI method for diaphragm shear strength and stiffness
2) FM wind uplift resistance
3) UL fire classification

g. Approved Types

1) For use with structural steel framing supports with top flange thickness 1/4 in. or thicker:
   a) Hilti X-ENP-19 L15 (1/4 in. or thicker)
   b) ITW/Ramset SP
2) For use with steel bar joist supports with top chord or flange thickness 1/8 in. to 3/8 in.:
   a) Hilti X-EDNK22 THQ12 (1/8 in. up to and including 1/4 in.)
   b) Hilti X-EDN19 THQ12 (3/16 in. up to and including 3/8 in.)
   c) ITW/Ramset 1500K and 1600WK

H. Sidelap Connectors

1. Acceptable types of sidelap connectors:

a. Top or side seam welds

1) 1½" long fillet welds in accordance with AWS D1.3 procedures.

b. Mechanical sidelap connectors

1) Drive mechanical sidelap connectors completely through adjacent lapped roof deck sheets to achieve positive engagement of adjacent sheets with a minimum of three thread penetration.
2) Material: ASTM A510 Grade 1022
3) Hardness: Minimum Vickers Surface Hardness of 450 HV0.3
4) Design and Manufacture: Hex washer head undercut with reverse serrations; self-piercing or stitch point at center
5) Corrosion Resistance:
   a) For steel roof decks with waterproofing membrane: 5 micron zinc electroplated in accordance with ASTM B633 SC1 Type III.
   b) For exposed steel roof decks: AISI 410 or 304 stainless steel with bonded neoprene washer.
6) Design Requirements:
   a) ICC-ES AC43 or SDI method for diaphragm shear strength and stiffness
   b) FM wind uplift resistance
7) Approved Types
   a) Hilti S-SLC01 M HWH Sidelap Connector
   b) Hilti S-SLC02 M HWH Sidelap Connector
   c) Hilti S-MD 10-16x3/4 HWH #3 Stainless Steel Screw
   d) Elco Textron
   e) ITW Buildex Teks

c. Button punches

1) Standard or proprietary type button punches shall be deep and positively engage the male and female side edges of adjacent interlocking deck sheets in accordance with steel deck manufacturer recommendations
2) Approved Types
   a) Wheeling Corrugating Gator Crimp
   b) Verco Manufacturing Punchlok

I. Galvanizing Repair Paint

Shall conform to the requirements of ASTM A780 and comply with Military Specification MIL-P-21035.

J. Deck Fasteners (if used)

Deck fasteners of a type that will provide equal or greater uplift resistance than a 3/4" puddle weld.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin placement of metal deck until all surfaces and members are deemed acceptable to receive the deck. Do not proceed with Work until any unsatisfactory conditions have been corrected to the satisfaction of the deck installer.

3.2 ERECTION

A. General

1. Care should be taken to avoid overloading the supporting structural elements when placing bundles of metal deck or other construction loads on floors and roof.

2. Do not use floor deck units for storage or working platforms until they are permanently secured.

3. Employ a Licensed Professional Engineer or Land Surveyor to ensure accurate erection of the deck and end closures.

B. Metal Deck and Accessories Installation

1. Lay units in strict accordance with manufacturer's instructions and requirements and as shown on Drawings.

2. Adjust units in place before permanent fastening and accurately align end to end. Rectify inaccuracies in alignment and level of bearing before units are finally placed.

3. Provide proper bearing at all supports. Metal deck must be placed to bear fully on surface of beam flanges.

4. Provide angle and channel supports for metal deck at locations where deck cannot be properly seated due to obstructions by structural connections and as shown on Drawings. Coordinate with mechanical trades to adjust supports at columns if required to permit items to pass adjacent to column.

5. Anchor deck to steel member by welding directly through the bottom of the rib at all structural supports by welds not less than 3/4" in diameter or by using powder driven fasteners of equivalent strength, spaced not more than 12" across the width of the unit. All welds shall be of uniform size and appearance and free of pinholes, porosity, undercutting or other defects. Welds shall be free of sharp points or edges. Mechanical fasteners shall be fully engaged and washer snug and holding deck without damage. Where two units abut, each unit shall be so fastened to the steel framing. Add additional welds or fasterners where found defective.

6. Fasten side laps of adjacent units between supports by crimping or mechanically fastening with sheet metal screws of size and spacing required by manufacturer or as indicated on the Drawings to provide diaphragm strength required by seismic design. In no case shall fasteners exceed two feet. Fasteners for exposed to view roof deck shall be the minimum length possible to to ensure an aesthetic appearance.

7. Furnish, install, and weld in position all accessories, including pour stops, closures, cant strips, etc., where required.

   a. Furnish sheet metal pour stops and closures for open ends of all cell raceways at columns, walls, and openings shown on Drawings. Pour stop gage is to be selected by manufacturer based on overhang. Revise gage if survey shows overhang exceeds that designed. Provide additional supports to strengthen pour stop at wedge inserts if required.
   b. Provide sheet steel cover plate (or closure tape) as required to close panel end conditions where panels change direction or abut.
   c. Furnish material for column closures to close openings between panels and structural columns.
   d. Provide welding hole cover, with friction fastening, to close welding access holes when required.
   e. Provide smooth form wood edge at locations where edge of deck will be exposed to view, such as at stairwells.

C. Stud Shear Connector Welding

1. Weld studs to steel beams through the steel deck with automatically-timed stud welding equipment.

2. Stud welding shall conform to the requirements of AWS D1.1 with respect to workmanship, quality control, and field inspection.

3. Manufacturer shall supply guidance and instruction in proper installation method

4. Additional requirements for stud welding with metal deck:

   a. Top flanges of beams must be free of paint, heavy rust, millscale, dirt, ice and water, and any other material that will interfere with the welding operation.
   b. Metal deck must be free of dirt, ice, water, and other foreign materials that will interfere with the welding operation.

D. Cutting, Drilling, and Reinforcing of Openings

1. Where predetermined openings (such as stairs, elevators, etc.) are framed by structural steel beams on all sides (shown on the Drawings), the metal deck shall be engineered by the manufacturer to fit these conditions.

2. Any opening which is not framed by structural steel beams on all sides, and which is required in steel decking, shall be cut by the respective trades requiring it.

3. Reinforcing of Openings in Steel Deck

   a. Holes 6" or less in dimension need not be reinforced.
   b. Holes greater than 6" but less than 30" in any dimension shall be reinforced by the General Contractor as shown on the Structural Contract Drawings.

E. Field Touch Up

Clean scarred and rusted areas in galvanizing after deck installation is completed and paint welds and the scarred and rusted areas with the galvanizing repair paint. Apply in accordance with the manufacturer's instructions.

3.3 TOLERANCES

A. Edge of metal deck is to be within a tolerance of 1/4” of theoretical, set to a survey line, to ensure proper installation of masonry and installation of relieving angles. Where deck is found to be out of tolerance, make corrections and resurvey prior to placement of concrete.

3.4 FIELD QUALITY CONTROL

A. Welding/fastening of metal deck and shear studs is subject to Special Inspection and Testing and is included as part of the Quality Control Work of Section 05120 and includes, but is not limited to.

1. Weld sizes and pattern.

2. Mechanical fastener placement location and washer condition.

3. Clamping of steel roof deck to supporting steel framing

B. The Contractor shall engage an engineer licensed in the state of New York to check tolerances and inspect the erection.

C. Contractors Surveys

Provide survey of locations of edge of deck with respect to theoretical edge of deck and building survey line. Indicate discrepancies between actual installation and Contract Documents. Surveys are to be submitted in a timely manner such that corrections can be made prior to placement of concrete. Do not proceed with placing concrete until the pour stop locations are corrected.

3.5 CLEANING

A. Metal deck and accessories to receive sprayed fireproofing shall be clean of dust, grease, excessive oils, loose materials, and any other matter which would impair the adhesion of the fireproofing material to the deck and accessories.

END OF SECTION 053100

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SECTION 055000 – METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

1.2 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

C. All materials, installation and workmanship shall comply with all applicable requirements and standards.

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in successfully producing metal fabrications similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.

B. Installer Qualifications: Arrange for installation of metal fabrications specified in this section by same firm that fabricated them.

C. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code Steel," D1.3 "Structural Welding Code Sheet Steel", and D1.2 "Structural Welding Code Aluminum."

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.4 SUBMITTALS

A. Product Data:

1. Product data and installation instructions for each prefabricated item of miscellaneous metal fabrications and accessories.

2. Samples representative of materials and finished products as may be requested by Owner.

B. Record Documents:

1. Shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other sections.

   a. Where installed metal fabrications are indicated to comply with certain design loadings, include structural computations, material properties, and other information needed for structural analysis that has been signed and sealed by the qualified professional engineer who was responsible for their preparation.

1.5 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.

1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabrication of products without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.2 FERROUS METALS

A. For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher leveled sheet.

B. Steel Plates, Shapes, and Bars: ASTM A 36.

C. Rolled Steel Floor Plates: ASTM A 786.

D. Steel Bars for Gratings: ASTM A 569 or ASTM A 36.

E. Wire Rod for Grating Cross Bars: ASTM A 510.

F. Steel Tubing: Product type (manufacturing method) and as follows:

1. Cold Formed Steel Tubing: ASTM A 500, grade as indicated below:

   a. Grade A, unless otherwise indicated or required for design loading.
   b. For exterior installations and where indicated, provide tubing with hot dip galvanized coating per ASTM A 53.

G. Uncoated Steel Sheet: Commercial quality, product type (method of manufacture) as follows:

   1. Cold Rolled Steel Sheet: ASTM A 366

H. Galvanized Steel Sheet: Commercial Quality; ASTM A 526, G90 coating designation unless otherwise indicated.

I. Steel Pipe: ASTM A 53; finishand type as follows:

   1. Black finish, unless otherwise indicated.

   2. Galvanized finish for exterior installations and where indicated.

J. Gray Iron Castings: ASTM A 48, Class 30.

K. Malleable Iron Castings: ASTM A 47, grade 32510.

L. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.

M. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A 47, or cast steel, ASTM A 27. Provide bolts, washers, and shims as required, hot dip galvanized per ASTM A 153.

N. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for the metal alloy to be welded.

2.3 EQUIPMENT SUPPORT SYSTEM

A. To establish standards of manufacture, operation, performance, and appearance, drawings and specifications are based on products of Unistrut Corporation. Provided compliance with requirements, products of other manufacturers may also be acceptable if accepted in advance by the Owner.

B. Provide all Metal Framing material, fittings and related strut system accessories as required by Project conditions. Rails at finished ceiling shall be on centers as required by equipment manufacturer and allow continuous attachment along any point on the rail. System shall be true, plumb and level to the tolerances indicated when maximum loading conditions are applied due to equipment operation.

   1. Support Members: "K series" X-Ray channel with spacing to allow installation of standard modular 24" ceiling fixtures and equipment.

2. Vertical Supports: 12 gage Telespar vertical supports with provision for both basic and micro vertical adjustments.

C. Loading: Design the support structure to support the maximum concentrated load that will be encountered by positioning the equipment at the extremities of its travel at any single point along the exposed rails.

D. Safety Factor: The system shall be designed with a minimum safety factor of 3 based upon ultimate strength under static loading conditions.

E. Provide all components finished with manufacturer's standard electro-galvanized finish.

2.4 STAINLESS STEEL

A. Bar Stock: ASTM A 276, Type 302 or 304.

B. Plate: ASTM A 167, Type 302 or 304.

2.5 ALUMINUM

A. Extruded Bars and Shapes: ASTM B 221, alloys 6063-T6:

B. Aluminum Alloy Rolled Tread Plate: ASTM B 632, alloys 6061-T6:

C. Aluminum Sheet for Expanded Aluminum Grating: ASTM B 209, alloy 5052 H32.

2.6 GROUT AND ANCHORING CEMENT

A. Nonshrink Nonmetallic Grout: Premixed, factory packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section.

1. "B-6 Construction Grout"; W. R. Bonsal Co.

2. "Diamond Crete Grout"; Concrete Service Materials Co.

3. "Euco N S Grout"; Euclid Chemical Co.

4. "Masterflow 928 and 713"; Master Builders.

5. "Sealtight 588 Grout"; W. R. Meadows, Inc.

6. "Sonogrout 14"; Sonneborn Building Products.

7. "Stoncrete NM1"; Stonhard, Inc.

8. "Five Star Grout"; U. S. Grout Corp.

9. "Vibropruf #11"; Lambert Corp.

B. Interior Anchoring Cement: Factory prepackaged, nonshrink, nonstaining, hydraulic controlled expansion cement formulation for mixing with water at Project Site to create pourable anchoring, patching, and grouting compound. Use for interior applications only.

1. "Bonsal Anchor Cement"; W. R. Bonsal Co.

2. "Por Rok"; Minwax Construction Products Division.

C. Nonshrink Metallic Grout: Premixed, factory packaged, ferrous aggregate grout complying with ASTM C 1107 2, specifically recommended by manufacturer for heavy duty loading applications of type specified in this section.

1. "Metox RM"; Chem Masters Corp.

2. "Hi Mod Grout"; Euclid Chemical Co.

3. "Embeco 885 and 636"; Master Builders.

4. "Ferrolith G Redi Mix and G NC"; Sonneborn Building Products Div., Rexnord Chemical Products, Inc.

2.7 FASTENERS

A. Provide zinc coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.

B. Bolts and Nuts: Regular hexagon head type, ASTM A 307, Grade A.

C. Lag Bolts: Square head type, FS FF B 561.

D. Machine Screws: Cadmium plated steel, FS FF S 92.

E. Wood Screws: Flat head carbon steel, FS FF S 111.

F. Plain Washers: Round, carbon steel, FS FF W 92.

G. Drilled In Expansion Anchors: Expansion anchors complying with FS FF S 325, Group VIII (anchors, expansion, [nondrilling]), Type I (internally threaded tubular expansion anchor); and machine bolts complying with FS FF B 575, Grade 5.

H. Toggle Bolts: Tumble wing type, FS FF B 588, type, class, and style as required.

I. Lock Washers: Helical spring type carbon steel, FS FF W 84.

2.8 PAINT

A. Shop Primer for Ferrous Metal: Manufacturer's or fabricator's standard, fast curing, lead free, universal modified alkyd primer selected for good resistance to normal atmospheric corrosion, for compatibility with finish paint systems indicated, and for capability to provide a sound foundation for field applied topcoats despite prolonged exposure complying with performance requirements of FS TT P 645.

B. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD P 21035 or SSPC Paint 20.

C. Bituminous Paint: Cold applied asphalt mastic complying with SSPC Paint 12 except containing no asbestos fibers.

2.9 FABRICATION, GENERAL

A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

C. Allow for thermal movement resulting from 100 degrees F (55.5 degrees C) maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.

D. Shear and punch metals cleanly and accurately. Remove burrs.

E. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

F. Remove sharp or rough areas on exposed traffic surfaces.

G. Weld corners and seams continuously to comply with AWS recommendations and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat head (countersunk) screws or bolts. Locate joints where least conspicuous.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

J. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

K. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.

L. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.10 ROUGH HARDWARE

A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 06 sections.

B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

2.11 STEEL LADDERS

A. Fabricate ladders for the locations shown, with dimensions, spacing, and anchorages as indicated. Unless otherwise indicated, fabricate ladders with component parts specified herein. Comply with requirements of ANSI A14.3.

B. Siderails: Continuous steel flat bars, 1/2 inch x 2 1/2 inches, with eased edges, spaced 18 inches apart.

C. Bar Rungs: Round steel bars, 3/4 inch diameter, spaced 12 inches on center.

D. Bar Rungs: Square steel bars, 3/4 inch, spaced 12 inches on center.

E. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.

F. Support each ladder at top and bottom and at intermediate points spaced not more than 5' 0" on center by means of welded or bolted steel brackets.

1. Size brackets to support design dead and live loads indicated and to hold centerline of ladder rungs clear of the wall surface by not less than 7 inches.

2. Extend side rails 42 inches above top rung, and return rails to wall or structure unless other secure handholds are provided. If the adjacent structure does not extend above the top rung, goose neck the extended rails back to the structure to provide secure ladder access.

G. Provide non slip surface on top of each rung, either by coating the rung with aluminum oxide granules set in epoxy resin adhesive, or by using a type of manufactured rung which is filled with aluminum oxide grout.

2.12 SHIP'S LADDERS

A. Provide ship's ladders where indicated. Fabricate of open type construction with structural steel channel or steel plate stringers, pipe handrails, and open steel grating treads, unless otherwise indicated. Provide all necessary brackets and fittings for installation.

B. See Section 057100 Steel Stairs.

2.13 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

2.14 MISCELLANEOUS FRAMING AND SUPPORTS

A. Provide steel framing and supports for applications indicated or which are not parts of structural steel framework, as required to complete work.

B. Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.

a. Except as otherwise indicated, space anchors 24 inches on center and provide minimum anchor units in the form of steel straps 1-1/4 inches wide x 1/4 inch x 8 inches long.

2.15 METAL BAR GRATINGS

A. Produce metal bar gratings of description indicated per NAAMM marking system that comply with the following:

1. Metal Bar Grating Standard "Standard Specifications for Metal Bar Grating and Metal Bar Grating Treads" published in ANSI/NAAMM A202.1 "Metal Bar Grating Manual."

2. Heavy Duty Metal Bar Grating Standard: "Guide Specifications for Heavy Duty Metal Bar Grating" published in NAAMM "Heavy Duty Metal Bar Grating Manual."

B. To establish standards of manufacturer, specification is based upon products of Reliance Steel Products, Inc. Subject to compliance with requirements, other manufacturers offering metal bar gratings that may be incorporated in the Work include, but are not limited to, the following:

1. Alabama Metal Industries Corp.

2. Barnett/Bates Corp.

3. Blaw Knox Grating Div., Blaw Knox Corp.

4. IKG Industries

5. Klemp Corp.

6. Ohio Gratings, Inc.

7. Seidelhuber Metal Products, Inc.

8. Trueweld, Inc.

C. Galvanized Steel Bar Grating: Provide Reliance Steel Products Company hot dipped galvanized steel "Type 3/4R4 Electro Pressure Welded" grating with 1-1/2 inch x ¼ inch bearing bars spaced at 1 inch centers and ½ inch x 3/16 inch rectangular cross bars spaced at 4 inch centers. Slot bearing bars for rectangular cross bars prior to electropressure welding. Provide banding bars of same size as bearing bars.

D. Prime Painted Steel Bar Grating: Provide Reliance Steel Products Company "Type 1R4 Electro Pressure Welded" grating with 1-1/2 inch x ¼ inch bearing bars spaced 1-1/4 inch centers and ½ inch x 3/16 inch rectangular cross bars spaced at 4 inch centers. Provide one shop coat Tnemec 10 99G (green) modified alkyd rust inhibitive primer as specified after fabrication.

2.16 STEEL PIPE RAILINGS AND HANDRAILS

A. Fabricate pipe railings and handrails to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of pipe, post spacing, and anchorage, but not less than that required to support structural loads.

B. Interconnect railing and handrail members by butt welding or welding with internal connectors, at fabricator's option, unless otherwise indicated.

1. At tee and cross intersections, notch ends of intersecting members to fit contour of pipe to which end is joined and weld all around.

C. Form changes in direction of railing members as follows:

1. By insertion of prefabricated elbow fittings.

2. By radius bends of radius indicated.

3. By mitering at elbow bends.

4. By bending.

5. By any method indicated above, applicable to change of direction involved.

D. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of pipe throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of pipe.

E. Provide wall returns at ends of wall mounted handrails, unless otherwise indicated.

F. Close exposed ends of pipe by welding 3/16 inch thick steel plate in place or by use of prefabricated fittings, except where clearance of end of pipe and adjoining wall surface is 1/4 inch or less.

G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnections of pipe and attachment of railings and handrails to other work. Furnish inserts and other anchorage devices for connecting railings and handrails to concrete or masonry work.

H. For exterior steel railings and handrails formed from steel pipe with galvanized finish, galvanize fittings, brackets, fasteners, sleeves, and other ferrous components.

I. For interior steel railings and handrails formed from steel pipe with galvanized finish, galvanize fittings, brackets, fasteners, sleeves, and other ferrous components.

J. For interior steel railings formed from steel pipe with black finish, provide nongalvanized ferrous metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.

2.17 STEEL AND IRON FINISHES

A. Galvanizing: For those items indicated for galvanizing, apply zinc coating by the hot dip process compliance with the following requirements:

1. ASTM A 153 for galvanizing iron and steel hardware.

2. ASTM A 123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick and heavier.

B. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC SP6 "Commercial Blast Cleaning."

2. Interiors (SSPC Zone 1A): SSPC SP3 "Power Tool Cleaning:

C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC PA1 "Paint Application Specification No. 1" for shop painting.

1. Stripe paint all edges, corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to the Project Site.

B. Center nosings on tread widths with noses flush with riser faces and tread surfaces.

C. Set sleeves in concrete with tops flush with finish surface elevations; protect sleeves from water and concrete entry.

D. Sequencing and Scheduling:

1. Sequence and coordinate installation of wall handrails as follows:

a. Mount handrails only on completed walls. Do not support handrails temporarily by any means not satisfying structural performance requirements.
b. Mount handrails only on gypsum board assemblies reinforced to receive anchors, and where the location of concealed anchor plates has been clearly marked for benefit of Installer.

3.2 INSTALLATION

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. All installation shall be in accordance with manufacturer's published recommendations.

C. Fastening to In Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors as required.

D. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

F. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units which have been hot dip galvanized after fabrication, and are intended for bolted or screwed field connections.

G. Field Welding: Comply with AWS Code for procedures of manual shielded metal arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

H. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint or zinc chromate primer.

3.3 FABRICATION

A. Provide miscellaneous metal work fabricated by processes and techniques which will result in the appropriate workmanship class as scheduled.

1. Class 1 Workmanship: Sandblast exposed surfaces smooth with pits, mill marks, nicks, and scratches filled and ground smooth so that no defects are visible from a distance of 6' after painting.

a. Conceal welds where possible. Where exposed, grind welds to small radius with uniform size cove. Welds shall be undetectable after painting.
b. Use only flat head countersunk bolts in exposed locations.
c. Fit all joints to hairline finish.
d. Distortions visible to the eye will be cause for rejection.

2. Items required to have Class 1 Workmanship include:

a. Stair railings, handrails, and guardrails in public and "high finish level" areas, interior and exterior.
b. Steel framed stairs in public and "high finish level" areas, interior and exterior.

3. Class 2 Workmanship: Grind exposed surfaces to remove surface irregularities. Moderate imperfections not visible at 20 feet may remain. Mill marks may remain.

a. Grind welds to small radius with uniform sized core and smooth transition between joined pieces.
b. Use only flat or oval head, countersunk bolts where exposed to view.
c. Straightness: Minor distortions will be permitted.
d. Joints: Provide maximum gap of 1/16 inches.

4. Items required to have Class 2 Workmanship include:

a. Stair railings, handrails, and guardrails in "back of house" areas, interior and exterior.
b. Steel ladders.
c. Steel framed stairs in "back of house" areas, interior and exterior.
d. Steel bollards.
e. Exposed door supports, guides, and bracing.
f. Lavatory countertop supports.
g. Garage overhead clearance bars.

5. Class 3 Workmanship: No improvement from mill finish required except preparation for priming and galvanizing.

6. Items required to have Class 3 Workmanship include all concealed items and those items exposed to view only in "service" areas such as mechanical equipment rooms, and other areas accessible only to building maintenance staff.

3.4 SETTING LOOSE PLATES

A. Clean concrete and masonry bearing surfaces of any bond reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.

B. Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.

1. Use metallic nonshrink grout in concealed locations where not exposed to moisture; use nonmetallic nonshrink grout in exposed locations, unless otherwise indicated.

2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 INSTALLATION OF STEEL PIPE RAILINGS AND HANDRAILS

A. Adjust railings prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated, or if not indicated, as required by design loadings. Plumb posts in each direction.

B. Secure handrails to wall with wall brackets and end fittings. Provide bracket with not less than 1-1/2 inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated, or if not indicated, at spacing required to support structural loads. Secure wall brackets and wall return fittings to building construction as follows:

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.

2. Use type of bracket with pre drilled hole for exposed bolt anchorage.

3. For concrete and solid masonry anchorage, use drilled in expansion shield and either concealed hanger bolt or exposed lag bolt, as applicable.

4. For hollow masonry anchorage, use toggle bolts having square heads.

5. For wood stud partitions, use lag bolts set into wood backing between studs. Coordinate with stud installations for accurate location of backing members.

6. For steel framed gypsum board assemblies, fasten brackets directly to steel framing or concealed anchors using self tapping screws of size and type required to support structural loads.

3.6 ADJUSTING AND CLEANING

A. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC PA 1 requirements for touch up of field painted surfaces.

1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 055000

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SECTION 057000 - ORNAMENTAL METAL

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide ornamental metal Work as indicated on the Drawings and as specified herein, including, but not limited to the following:

1. Subway Type Grating
2. Iron Fences and Railings
3. Steel members at Expansion Joints
4. Stainless Steel (miscellaneous items)
5. Aluminum Railings
6. Miscellaneous Ornamental Metal Work
7. Painting

1.2 REFERENCES

A. References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

B. American Society for Testing and Materials (ASTM).

C. American Welding Society (AWS).

D. National Association of Architectural Metal Manufacturers (NAAMM).

E. Federal Specifications (FS).

F. The Society for Protective Coatings (SSPC, formerly Steel Structures Painting Council).

G. The American Galvanizers Association

1.3 DESIGN REQUIREMENTS

A. Definitions in ASTM E985 for railing-related terms apply to this Section.

B. Structural Performance: Design, engineer, fabricate, and install the following metal fabrications to withstand not less than the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections as per Section BC 1607.7 of the 2014 NYC Building Code. Apply each load to produce the maximum stress in each respective component of each metal fabrication. In cases where local requirements are more stringent they shall apply. Where railings support fixtures or other imposed loads, allowance shall be made for the additional loads.

1. Handrails

   a. Uniform load of 50 lb/ft applied in any direction at the top and to transfer this load to the supports.
   b. Concentrated load of 200 pounds applied in any direction at any point and to transfer the load to the supports.
   c. The uniform and concentrated loads need not be assumed to act concurrently.

2. Top Rail of Guardrail Systems

   a. Uniform load of 50 lb/ft applied in any direction at the top and to transfer the load to the supports.
   b. Concentrated load of 200 pounds applied in any direction at any point and to transfer the load to the supports.
   c. The uniform and concentrated loads need not be assumed to act concurrently.

3. Infill of Rail Systems: panels, balusters, intermediate railings, and other elements composing the infill area must resist the following combination loading. Reactions due to this combination loading are not required to be applied simultaneously with one another and are not required to be superimposed with those in paragraphs 1 and 2 above.

   a. A concentrated normal load of 50 pound applied horizontally on an area of 1 sq. ft., including openings and spaces between rails.
   b. A vertically downward load of 50 lb/ft applied at the most critical locations.
   c. Concentrated upward load of 50 pounds applied at the most critical location.

1.4 SUBMITTALS

A. Product Data: Manufacturer's technical data for products and processes used, including finishes and anchorage materials.

B. Shop Drawings

1. Show all locations, markings, quantities, materials, sizes and shapes.

   Show full size details of fabrication and installation for each ornamental metal item required including plans, elevations, profiles of fittings, connections, anchors, details of components and attachments to other units of Work.

   a. Indicate materials, profiles of each ornamental metalwork member and fitting, joinery, finishes, fasteners, anchorages and accessory items.
   b. Include setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as unit of Work of other Sections.

2. Do not fabricate before approval of Shop Drawings.

C. Calculations

Where metal items are required to comply with certain design loadings, submit structural design, structural calculations, materials properties, and other information needed for structural analysis, signed and sealed by the New York State licensed Professional Engineer responsible for their preparation.

D. Samples

1. Submit sample of each item of hardware provided in this Section.

2. Upon request of the RIOC, submit one sample of each item included in this Section, for approval.

3. Samples for verification: Prepare samples of each type of metal finish required on metal of same thickness and alloy indicated for final work. Where finish involves normal color and texture variations, include sample sets composed of two (2) or more units showing limits of such variations expected in completed work.

   a. Include 6 inch long samples of linear shapes
   b. Include 6 inch square samples of plates.
   c. Include full-size samples of castings and forgings.

E. Qualification data for firms and persons specified in Article titled “Quality Assurance” to demonstrate their capabilities and experience.

1. Provide proof of Zinc Metallizer’s qualifications specified under “Quality Assurance”; certification of qualifications meeting Military Standard by one of the following:

a. A branch of the U.S. Dept. of Defense(DoD),or
b. A company certified by U.S. Dept. of Defense; submit DoD certification for this company, or
c. The Society for Protective Coatings (SSPC).

2. Hot Dip Galvanizer/Powder Coating Applicator: Provide proof of Galvanizer/Applicator's qualifications by submittal of the following:

a. Galvanizer's written Quality Control/Quality Assurance manual for hot dip galvanizing and factory applied coatings.
b. Certification from the American Galvanizers Association that Galvanizer has completed all course requirements and is a certified Master Galvanizer.

F. Test Reports

Submit test reports for zinc metallizing or hot dip galvanizing and coating system as specified herein, paragraph titled "Galvanizing by the Zinc Metallizing Process; or Hot Dip Galvanizing; with Finish Coating".

G. Warranty

Warranty as specified herein.

1.5 QUALITY ASSURANCE

A. All fabricated items

Fabricator shall have a minimum of three (3) years successful experience in the fabrication of items of type specified.

B. Shop assemble items wherever possible.

C. The installer shall have a minimum of three (3) years successful experience installing work of the type specified.

Installer shall be acceptable to the fabricator.

D. Engineer Qualifications: Professional engineer licensed to practice in jurisdiction where project is located and experienced in providing engineering services of the kind indicated that have resulted in the successful installation of metal items similar in material, design, and extent to that indicated for this project.

E. Zinc metallizer: The company or individual responsible for application of zinc metallizing shall be certified as qualified to perform this process by one of the following:

1. Certification in accordance with Mil Std 2138 or Mil Std 1687 by a branch of the U.S. Dept. of Defense, or by a company that is certified by the Dept. of Defense in accordance with either one of these military standards.

2. Thermal Spray Certification by The Society for Protective Coatings (SSPC).

The firm providing the zinc metallizing shall also perform the painting of the members at the shop also to provide a single source responsibility.

F. Hot-Dip Galvanizer/Powder Coating Applicator: The company or individual responsible for application of hot dip galvanizing with a powder coat finish shall be certified as qualified to perform this process by the following:

1. Certification from the American Galvanizers Association that Galvanizer has completed all course requirements and is a certified Master Galvanizer.

2. Certification from the manufacturer of the powder coatings that the galvanizer is an approved applicator of said manufacturer's material and meets all application and performance criteria.

1.6 PRODUCT HANDLING

A. Tag all items to agree with shop drawing designations.

B. Brace and support large components to prevent deformation in transit, and store in dry area.

C. Before shipment to the job, all finished metal shall be adequately protected for transporting and erecting periods.

D. Store aluminum, bronze, and stainless steel components and materials in clean, dry location, away from uncured concrete and masonry. Cover with waterproof paper, tarpaulin or polyethylene sheeting in a manner that permits air circulation within covering.

E. Replace damaged items, with the approval of the Project Architect, and at no additional cost to the RIOC.

1.7 JOB CONDITIONS

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of ornamental metalwork. Do not delay job progress; allow for adjustments and fitting where taking of field measurements before fabrication might delay Work.

B. Determine location of supporting construction provided by other trades.

C. Interface With Other Systems: Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchors, including concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which will be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

D. Coordinate with other trades in scheduling delivery and installation.

1.8 WARRANTY

A. Warranty for metal fabrication items with galvanizing by zinc metallizing or hot dip galvanizing, and finish coated with epoxy paint system or powder coat system: The coating applicator's/Contractor's warranty that items shall not show signs of rust, and finish shall be fully warranted against peeling, cracking, crazing, blistering, chalking and fading for a period of 5 years from date of installation of products. If rusting or failure of coating occurs, new items shall be provided or coating shall be refurbished in the shop. Warranty includes labor to remove and replace the items.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Metals

1. Steel and Iron: Provide steel and iron in the form indicated, complying with the following requirements:

a. Tubing: Cold-formed, ASTM A500; or hot-rolled, ASTM A501
b. Steel Plates, Shapes and Bars: ASTM A36
c. Gray Iron Castings: ASTM A48, Class 30
d. Malleable Iron Castings: ASTM A47, grade as recommended by fabricator for type of use indicated
e. Steel rods: ASTM A108

2. Stainless Steel: Provide austenitic stainless steel in form indicated, complying with the following requirements.

a. Plate, Sheet and Strip: ASTM A204, Type 302/304
b. Tubing: ASTM A554, Grades MT 301, MT 302, or MT 304, as standard with manufacturer.
c. Pipe: ASTM A312, Grade TP 304
d. Bars and Shapes: ASTM A276
e. Castings: ASTM A743, Grade CF 8 or CF 20

3. Aluminum: Provide alloy and temper recommended by aluminum producers or finisher for type of use and finish indicated, and with not less than the strength and durability properties of the alloy and temper designated below for each aluminum form required.

   a. Extruded Bar and Shapes: ASTM B221, 6063-T6
   b. Extruded Pipe and Tube: ASTM B429, 6063-T6
   c. Drawn Seamless Tube: ASTM B483, 6063-T832
   d. Plate and Sheet: ASTM B209, 6061-T6 [3003-H16]. [Use alloy 5005-H16 for anodic coatings.]
   e. Castings: ASTM B26 or ASTM B108

B. Paint

1. Shop Primer, interior Work: Acrylic rust-inhibitive type containing no lead equal to Tnemec 115 Unibond or Carboline Carbocrylic 3358. Paint must meet SCAQMD standards for VOC emissions.

2. Shop Primer, exterior Work except galvanized items: primer for epoxy coat system as specified in Section 09900-Painting.

3. Finish Paint – Refer to Section 09900.

C. Galvanizing by the Zinc Metallizing Process or Hot Dip Galvanizing; and Finish Coating

1. Zinc/aluminum metallizing (referred to herein as zinc metallizing) is the process of thermally applying an 85/15 zinc-aluminum wire over the surface of steel.

2. Zinc metallizing, or hot dip galvanizing, and finish coating system shall have the following performance characteristics and results of tests performed on representative samples. Finish coating for metallizing shall be either epoxy coating system or powder coating. Finish coating for hot dip galvanizing shall be powder coating (See paragraph 3 below for acceptable system):

   a. Adhesion: Test zinc metallizing/hot dip galvanizing with complete finish coating (epoxy coating system or powder coating system) in accordance with ASTM D4541, Test Method E. Pull-off strength throughout the system shall be not less than 750 psi before and after environmental cycling.
      Environmental cycling shall be 10 cycles of the following: 4 hrs at 100% humidity per ASTM D1735; 16 hours below 0°F; and 4 hours at 140°F.
   b. Corrosion resistance of zinc metallizing/hot dip galvanizing with epoxy coat system or powder coating: A rating of 10 after 1000 hours salt fog (prohesion method) when tested in accordance with ASTM D1654, Procedure A. Scribe shall be cut through all

coatings to bare steel substrate. Expose specimens in accordance with ASTM G85.

c. Powder coating complying with the following ASTM standards:
Adhesion: ASTM D3359, no loss.
Hardness: ASTM D3363 (pencil), H min.
Falling Sand: ASTM D968 20L/mil.
Salt Spray: ASTM B117, passes 3000 hrs.
Humidity: ASTM D2247, 3000 hours, few #8 blisters.
Impact Resistance (3mm): ASTM D2794, no loss.
Color Retention: ASTM D2244, 5 year less than or equal to 5 delta E.
Chalk Resistance: ASTM D4214, #8 rating.
Gloss Retention: ASTM D523, greater than or equal to 30 percent retention.
Erosion Resistance: ASTM B244, less than 10 percent film loss.
Compliance: AAMA 2604.

3. Hot Dip Galvanizing with Powder Coating Finish

a. As a system equivalent to zinc metallizing, it is permitted to use the Duncan Colorgalv Thermoset process of hot dip galvanizing with powder coat finish. Galvanizing coating thickness grade per ASTM A123 shall be 100, with DFT mil thickness coating not less than 3.6 to 3.9 mils.

b. Powder coating thickness shall be as specified in this specification. Coating shall include an architectural grade primer.

4. Galvanizing repair paint for regalvanizing welds and damaged areas shall conform to ASTM A780 and comply with Military Specification MIL-P-21035B, such as ZRC Cold Galvanizing Compound.

D. Miscellaneous Materials

1. Welding Electrodes and Filler Metal: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded, complying with applicable AWS specifications, and as required for color match, strength, and compatibility in fabricated items.

2. Fasteners: Use fasteners of same basic metal as the fastened metal, unless otherwise indicated. Do not use metals which are corrosive or incompatible with materials joined.

a. Provide concealed fasteners for interconnection of ornamental metal components and for their attachment to other work except where exposed fasteners are unavoidable or are the standard fastening method for ornamental metal system indicated.

b. Provide Phillips truss or pan-head machine screws for exposed fasteners, unless otherwise indicated.

c. Provide vandal resistant fasteners where indicated on the drawings.

3. Anchors and Inserts: Provide anchors of type, size, and material required for type of loading and installation condition shown, as recommended by manufacturer, unless otherwise indicated. Anchors installed in concrete shall have current ICC-ES listing for performance in cracked concrete as per Section BC 1912. For those anchors exposed to the elements, provide galvanized, stainless steel, or brass depending on the material being anchored.

4. Grout and Anchoring Cement

a. Nonshrink Metallic Grout: Premixed, factory-packaged, ferrous aggregate grout complying with Federal Specification CE CRD-C 621 or ASTM C1107 specifically recommended by manufacturer for heavy-duty loading applications of type specified in this section.

b. Nonshrink Nonmetalic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, non-gaseous grout complying with Federal Specification CE CRD-C 621 or ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section.

c. Erosion-Resistant Anchoring Cement: Factory-prepackaged, nonshrink, nonstaining, hydraulic controlled expansion cement formulation for mixing with water at project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without need for protection by a sealer or waterproof coating and is recommended for exterior use by manufacturer.

d. Products: Subject to compliance with requirements, provide one of the following:

1) Nonshrink Metallic Grouts:
"Hi Mod Grout", Euclid Chemical Co.
"Embeco 885 and 636", Master Builders
"Ferrolith G Red-Mix and G-NC", Sonneborn Building Products Div., Rexnord Chemical

2) Nonshrink Nonmetallic Grouts:
"Euco N-S Grout", Euclid Chemical Co.
"Crystex", L & M Construction Chemicals, Inc.
"Masterflow 713", Master Builders
"Sonogrout", Sonneborn Building Products Div., Rexnord Chemical Products, Inc.
"Five Star Grout", U.S. Grout Corp.

2.2 METAL FINISHES

A. Comply with NAAMM "Metal Finishes Manual" for recommendations and designations of finishes, except as otherwise indicated.

B. Stainless Steel Finishes:

1. Polished and Buffed Finish: Fine grit followed by buffing.

2. AISI No. 4 Finish: (App. 80 Grit directional satin finish)

3. AISI No. 6 Finish: (App. 120 Grit directional satin finish)

4. AISI No. 8 Finish: (Mirror-like, reflective, non-directional polish)

C. Aluminum Finishes:

1. Class 1 Clear Anodized Finish: AA-M32C22A41 (medium satin directional textured mechanical finish; chemical etch, medium matte; 0.7 mil min. thick clear anodic coating) complying with AAMA 611-12.

2. Class 1 Color Anodized Finish: AA-M12C22A42/44 (mechanical finish, nonspecular as fabricated; chemical etch, medium matte; 0.7 mil min. thick electrolytically deposited or integrally colored anodic coating) complying with AAMA 611-12. Color as selected by the Architect.

D. Painted Finishes:

Refer to Section 09900 for painting and this Section 05700 for galvanizing and painting.

2.3 FABRICATION

A. General

1. Fabricate ornamental metal to design, dimensions and details shown. Provide ornamental metal members in sizes and profiles shown, and not less than required to comply with requirements indicated for structural performance.

a. Fabricate surfaces exposed to view from materials that are smooth and free of surface blemishes.
b. Do not use materials which have strains, imperfections and discolorations, including welds at metal surfaces.
c. Fabricate and assemble items with directional finishes so that finish is uniform and in the same direction, unless otherwise indicated.

2. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature, in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and night time sky heat loss.

   a. Temperature Change (Range): 100°F (55.5°C).

3. Form exposed work true to line and level, with flush surfaces and accurate angles. Ease exposed edges to radius of approximately 1/32 inch, unless otherwise indicated. Miter exposed corner joints unless otherwise indicated, and machine fit to hairline joint.

4. Complete cutting, fitting, forming and drilling, including grinding of metal work, prior to cleaning, finishing, surface treatment and application of finishes.

5. Provide reinforcement and anchorage required to fulfill performance requirements. Provide brackets and miscellaneous components required for complete installation. Provide reinforcement sufficient to withstand the anticipated loading and stresses at anchorage and fastener locations, and hardware connections.

6. Provide brackets, plates and straps with each assembly, as required for proper support and anchorage to other work.

7. Cut, reinforce, drill and tap ornamental metal work to receive hardware and similar items.

8. Nonwelded Connections: Fabricate ornamental metal for interconnection of members by means of concealed mechanical fasteners and fittings unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

9. Conceal fastenings unless otherwise shown and accepted on final shop drawings.

10. Welded Connections: Use welding method which is appropriate for metal and finish indicated and which develops strength required. Finish exposed welds and surfaces smooth, flush, and blended to match adjoining surfaces.

11. Weld corners and seams continuously and in accordance with recommendations of AWS and CDA. Grind exposed welds smooth and flush, to match and blend with adjoining surfaces.

12. Form changes in direction of ornamental metal members by radius bends, or by mitering.

13. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain profile of member throughout entire bend without buckling, twisting, or otherwise deforming exposed surfaces of ornamental metal components.

14. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

15. Shop Applied Finishes: Apply shop finishes to match accepted control samples, with direction of grain as indicated on accepted shop drawings, for uniform appearance unless otherwise shown or directed by the Architect.

16. Separate dissimilar metals with separator material or coating recommended by fabricator to prevent corrosion and galvanic action. Do not extend coating onto exposed surfaces.

17. Provide factory applied protective covering as required to protect assemblies from damage during shipping and installation.

B. Subway Type Gratings

1. Provide complete with banding bars, over areaways and in Outside Air Intakes where indicated, steel subway gratings Type C, pressure-locked, as manufactured by Borden Gratings, Beeton, Ontario, Canada, or equivalent by Harsco IKG, Channelview, TX. 11/16” x 4" grid. Bearing bars 2½” x 3/16” spaced 11/16” on center. For locations, see Drawings.

2. Provide angle frames and shelf angle supports.

3. Portions of area windows projecting above area gratings shall be provided with subway type window guards where indicated on Drawings.

4. Provide galvanized finish.

C. Iron Fences and Railings

1. Provide where indicated on Drawings iron railings, fences, and gates constructed in accordance with the Drawings and Specifications, and as required to support structural loads. Rail systems, including guardrail systems, handrail systems, and infill, shall meet or exceed requirements for structural performance described in Article titled “System Performance Requirements”. Materials of fences and railings: medium steel, shapes as indicated on the Drawings.

2. Posts and braces shall be set in anchoring grout into cast-iron shoes, which shall be embedded in the concrete pavements or blocks. Members shall be centered in sleeve to provide uniform thickness of grout around member. Top 1/2" of material in sleeve is to be polyurethane sealant (Refer to Section 07900), pitched to shed water. Center picket of each panel of 6' fence: set in anchoring grout 2" minimum into curb or pavement, sealed with polyurethane sealant (Refer to Section 07900). Fences and railings on stone copings, platforms, steps or check block: set with anchoring cement into sockets cut in receiving material. Gates: hung with hinges made as indicated on Details. Provide all hasps required for locking gates in both open and closed positions. Provide for double and quadruple gates sliding lever bolts and galvanized, malleable iron catches having pipe anchor and drain embedded in concrete. Gates shall be locked open/closed with Type C Padlocks. Rivet the padlock chains to the gates as required for secure attachments. Single gates require one padlock; double gates two padlocks; quadruple gates four padlocks."

3. Furnish cast-iron shoes as indicated on Drawing Details for fence posts and set them at the proper time so that they may be cast into the concrete footing and pavements with top flush with finished surfaces.

4. Provide fast pin for folding swing gates to hold in closed position.

5. Unless otherwise indicated, and subject to structural performance requirements, center rails and side rails on outside steps shall be made of 1¼" solid posts with 2½" by 1/2" horizontal flats spaced as indicated, with top rail of two bronze, aluminum or steel channels and flat steel stiffener assembled as indicated. Post at upper level of center railings shall be of malleable cast iron of height indicated, tapering from 1¾" at bottom to 1¼" at top, with finial. All posts shall be set with anchoring cement into 4"deep sockets in cheeks and steps.

6. Provide galvanizing and finish paint.

D. Steel Members at Expansion Joints

Provide all rolled steel members with required anchors at structural expansion joints through slabs as indicated on Drawings or otherwise required. Items cast in concrete shall be furnished when required for setting. Provide bronze plates as indicated or otherwise required; top surfaces of plates shall be "BRONZOGRIT" or approved equal.

E. Stainless Steel (Miscellaneous Items)

1. Angle and Channel Guards

Provide angle and channel guards at locations indicated. Guards: 12-gauge stainless steel satin finish of length and dimensions required,

secured in place with oval head stainless steel fasteners and construction adhesive.

Corner Guards in the Kitchen shall be provided under Section 11400: Food Service Equipment.

F. Aluminum Railings

1. Provide aluminum railings as indicated on the Drawings. Rail systems, including guardrail systems, handrail systems, and infill, shall meet or exceed requirements for structural performance described in Article titled “System Performance Requirements”. Provide center and side rails, and wall handrails. Post: 2" square minimum. Unless indicated otherwise on the Drawings, posts shall be solidly set with molten sulphur or other approved non-electrolytic material into a combination 1/4" pipe sleeve and base plate welded to same, centered in the sleeve; sleeve shall be welded to stair string or tread to suit condition, or set in concrete.

2. All aluminum railings shall have Architectural Class 1 Clear Anodized Finish: Aluminum Association - A41 (clear film 0.7 mil or thicker).

2. 4 PAINTING

A. All miscellaneous ferrous metal work, except those members designated to be galvanized, before leaving the shop shall be given one shop coat of paint, and coatings as specified herein. For those items to be zinc metallized or hot dip galvanized and finish painted, apply coatings in the shop as specified herein.

B. Cleaning and Surface Preparation

1. Clean all steel first in accordance with SSPC-SP1.

2. Clean steelwork not to be painted (except steel work to be galvanized) in accordance with SSPC-SP2.

3. Clean steelwork to be painted within the same day as it will be applied and in accordance with the following methods, determined by location and exposure:

a. Interior steel not exposed to view: SSPC-SP2.
b. Interior steel exposed to view: SSPC-SP3.
c. Cavity wall and exterior steel exposed to weather: SSPC-SP6.

C. Shop Coat

1. Apply steel primer paint (general application) at a rate to provide dry film thickness of 2.0 to 3.5 mils. Apply primer paint (cavity wall and exterior

application) at a rate to provide dry film thickness of 4.0 to 6.0 mils. Provide full coverage of joints, corners, edges, and exposed surfaces.

2. Apply to dry surfaces only, when surface temperatures are above dew-point, by brush, spray, or roller, thoroughly and evenly, in strict accord with manufacturer's instructions for every detail of handling.

3. Apply second coat of the approved primer, in a darker shade, to surfaces inaccessible to painting after assembly or erection.

4. Protect machined surfaces with an approved rust-inhibiting coating that is readily removable prior to erection.

D. Finish Paint

Provide as per Section 09900.

2.5 GALVANIZING AND FINISH COATING

A. General

Galvanize the following items:

All miscellaneous ferrous metal Work (except cast iron) exposed to the weather, or located in exterior wall or roof construction, and any other steel members indicated as galvanized on the Drawings or Specifications.

1. Items that are to be finish painted shall be galvanized by the zinc metallizing process or hot dip galvanized, and finish coated as specified herein.

B. Zinc Metallizing-Finish Coating Applicators:

1. Atlantic Coast Metallizing & Coatings Corp., Melville, NY

2. Avant Guards Manufacturing, Brooklyn, NY

3. East Coast Metallizing & Coating Systems Inc., Westbury, NY

4. Island Wide Sandblasting Inc., Wyandanch, NY

5. Reneuxit LLC, West Chester, PA

C. Hot Dip Galvanizing with Powder Coating Finish

1. Duncan Galvanizing Corp, Everett, MA

D. Powder Coating Materials

1. Tiger Drylac, Ontario, California; Series 38 Super Durable Powder Coating.

2. PPG Industries, Pittsburgh, PA; Coraflon Ultradurable Powder Coating.

3. The Sherwin-Williams Co., Cleveland, OH; Powdura Super Durable Powder Coatings Series.

E. Cleaning and Surface Preparation

1. Hardware (bolts, nuts, etc.): Clean and leave free of mill scale before galvanizing.

2. Clean all steel first in accordance with SSPC-SP1 if needed.

3. Steel members: Clean in accordance with SSPC-SP8 before hot-dip galvanizing.

4. Steel members: Clean in accordance with SSPC-SP10 before zinc metallizing. Surface shall have a 3.0 to 4.0 mil anchor pattern. Moisture cannot be present on steel and temperature cannot be less than 5°F above the dew point. Thermal spray must be applied within 4 hours of blasting.

F. Shop Coat - Hot-dip Galvanizing Only – Required for galvanized items not indicated to receive finish paint coat.

1. Galvanize hardware in accordance with ASTM A153.

2. Galvanize steel shapes in accordance with ASTM A123. Apply zinc coating as per Thickness Grade specified in ASTM A123.

G. Shop Coat – Galvanizing by the Zinc Metallizing Process – Provide for all galvanized items indicated to receive finish paint, which includes all galvanized items exposed to public view and other items shown on Drawings or specified herein. Finish paint shall be the epoxy coat system or the powder coat system; producing a smooth, uniform surface, free of bubbles, runs, or sags. Hot Dip Galvanizing with powder coat finish is also permitted as specified in Paragraph H below.

1. Thermally spray metallizing material at a rate of 4.0 to 6.0 mils DFT. Sprayed coating shall be free of lumps, blisters, and loosely adhering particles. Coating shall be capable of passing the inspection requirements of Mil Std 2138A(SH) of 5/13/92, but with adhesion 750 psi minimum per ASTM D4541, Test Method E.

2. Epoxy Coating System, as specified in Section 09900: After the metallizing material has cured, apply a first coat of paint at a rate of 4.0 to 6.0 mils DFT, Polyamide Epoxy Paint such as Tnemec Series 27 FC

Typoxy. Top coat shall be Acrylic Aliphatic Polyurethane such as Tnemec Series 73 Endura-Shield, applied at a rate of 2.0 to 3.0 Mils DFT.

3. Powder Coating System: After the metallizing material has cured, properly prepare the item and apply Tiger Drylac Series 38 Super Durable Powder Coating; or PPG Industries Coraflon Ultradurable Powder Coating; or Sherwin-Williams Powdura Super Durable Powder Coatings Series system.

   a. Oven bake item for 20 minutes at 450°F, and remove all oil and grease. Cool surface to 72°F, clean with an organic solvent. Apply paint within 3 hours of final cleaning.
   b. Apply an out-gas-forgiving primer at the rate of 2-3 mils DFT. Oven cure material at 400°F for 10 minutes.
   c. In order to avoid oxidation, final topcoat must be applied within 12 hours.
   d. Apply a lead-free TGIC polyester powder topcoat finish at a rate of 4.0 to 5.0 mils DFT.
   e. Oven cure at 400°F to 450°F, for 30 minutes, or as recommended by coating manufacturer.

H. Hot Dip Galvanizing with Powder Coating Finish

As a system equivalent to zinc metallizing, it is permitted to use the Duncan Colorgalv Thermoset process of hot dip galvanizing with powder coat finish. Galvanizing coating thickness grade per ASTM A123 shall be 100, with DFT mil thickness coating not less than 3.6 to 3.9 mils.

1. Comply with ASTM A123 for fabricated products and ASTM A153 for hardware, with zinc coating thicknesses not less than those specified in this specification Section 05700, 3.6 to 3.9 mils DFT.

2. Fill vent holes after galvanizing, if applicable, and grind smooth.

3. Galvanizing shall exhibit a rugosity (smoothness) 4 rug or less (16-20 microns of variation) when measured by a profilometer over a 1 inch straight line on the surface of elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1 micron increments.

3. The incoming material shall be inspected, material hung on a rack or chain to be galvanized.

4. Material submerged into caustic cleaner removing the organics from the surface and rinsed with water.

5. Material pickled with hydraulic acid removing iron oxides from the surface and rinsed with water.

6. Material submerged into a flux removing any oxides that have formed after pickling and protecting the material from further formation of additional oxides before being galvanized.

7. The material submerged into Zinc bath at 850°F.

8. The material shall be allowed to naturally cool and not quenched with water or chemicals.

9. The galvanizing shall be inspected and pre-finished, removing edge tears, spikes, drips, or sharp protrusions which could cause potential harm to someone handling or using the material.

10. The Galvanized material shall be abraded to create a 1-1.5 mil profile for surface preparation. The profile shall be produced by abrasive blasting and or hand abrading.

11. The galvanized material shall be inspected prior to powder coating to determine conformance of the material to ASTM A123 and this specification Section 05700 for quality and thickness of zinc coating, not less than 3.6 to 3.9 mils DFT.

12. The galvanized surface profile shall be measured at 1-1.5 mils and recorded utilizing Press-O-Film tape.

13. All galvanized material shall be outgassed after profiling and before powder coat application.

14. A coating inspection form shall be filled out completely with material information, application conditions, and quality standards.

15. All powder coating products shall be electrostatically applied following the recommendations of the powder supplier and the requirements of the powder coating Manufacturers Technical Data Sheet, and with Dry Film Thickness not less than is specified in this specification Section 05700.

16. The first coat shall consist of an Epoxy Primer powder applied at not less than 2.0 – 3.0 mils Dry Film Thickness. The powder shall be heated to 400°F to provide adhesion with the next coat of powder, and in accordance with the manufacturer's recommendations.

17. The next coat of powder to be applied shall be Sherwin Williams Powdura Super Durable or approved equal applied at a dry film thickness of not less than 4.0-5.0 mils. The surface of the fabrications after applying the powder shall be heated to 400°F for at least 10 minutes to cure the powder and in accordance with the manufacturer's recommendations. The color of the powder shall match the approved color sample that will be approved by the Project Architect.

18. All repairs of galvanizing shall follow ASTM A780.

19. All repairs to powder coating shall be sanded and feathered with the surrounding area. The damaged area shall be cleaned and abraded to receive a powder or liquid coating. The liquid coating can be applied using either a spray or brush method.

20. Apply powder coating system within time frame after galvanizing as part of the Duncan Colorgalv process to ensure oxides will not form and GoldGalvthermoset process will be complete.

PART 3 - EXECUTION

3. 1 INSPECTION

A. Make all required measurements in the field to ensure proper and adequate fit.

3. 2 DISCREPANCIES

A. Immediately notify Architect.

B. Do not proceed until fully corrected.

3.3 FURNISHED IN THIS SECTION, INSTALLED IN OTHERS

A. For items furnished under this Section and installed under other Sections, submit items to installer at such time that will not impede the progress of the installer's other Work.

3.4 ERECTION OR INSTALLATION

A. Provide anchorage devices and fasteners where necessary for securing ornamental metal items to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.

1. Provide inserts, setting plates, and other items of concealed work required for attachment of ornamental metal work, in a timely manner to facilitate on going construction.

B. Perform cutting, drilling, and fitting required for installation of ornamental metal work. Set work accurately in location, alignment, and elevation, plumb, level, true, and free of rack, measured from established lines and levels. Do not weld, cut, or abrade surfaces of ornamental metal components that have been coated

or finished after fabrication and are intended for field connection by mechanical means without further cutting or fitting.

C. Fit exposed connections accurately together to form tight, hairline or, where indicated, with uniform reveals and spaces for sealants and joint fillers. Where cutting, welding and grinding are required for proper shop fitting and jointing of ornamental metal items, restore finishes to eliminate any evidence of such corrective work.

D. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing or provide new units as required.

E. Install concealed gaskets, joint fillers, insulation and flashings as the work progresses, so as to make work weathertight, soundproof or lightproof as required.

F. Restore protective coverings that have been damaged during shipment or installation of the work. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at the same location.

1. Retain protective coverings intact and remove simultaneously from similarly finished items to preclude non-uniform oxidation and discoloration.

G. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal-arc welding, for appearance and quality of welds made, and for methods used in correcting welding work. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind exposed welded joints smooth and restore finish to match finish of adjacent surfaces.

H. Corrosion Protection: Coat concealed surfaces of aluminum and steel which will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

I. Adjust ornamental metal work prior to anchoring to ensure matching alignment at abutting joints.

J. Install items as detailed in the drawings; for manufactured items, install as recommended by the Manufacturer, unless indicated otherwise.

K. Coordinate with other trades involved.

L. Field Touch-Up

1. Painted Members: After erection, clean all damaged areas in shop coat, exposed surfaces of bolts, bolt heads, nuts and washers, abrasions, and all field welds and unpainted areas adjacent to field welds to the same

standards as the shop coat and paint with primer paint to same thickness as the shop coat. Finish painting is specified in Section 09900.

2. Galvanized Members: After erection, clean and paint all damaged areas to the galvanizing, welds, and areas adjacent to welds with the galvanizing repair paint complying to ASTM A780. For galvanized members to be painted, finish painting shall be the final two coats of the epoxy coating system. If applied in shop, touch up shall be the final two coats. For powder coating system follow instructions of the powder coat manufacturer, to match surrounding undamaged areas.

3.5 PROTECTION

A. Protect finishes of ornamental metal work from damage during construction period by use of temporary protective coverings approved by ornamental metal manufacturer. Remove protective covering at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items which cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 057000

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SECTION 057100 - STEEL STAIRS (SHIPS LADDERS)

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Provide Steel Stairs Work as described herein and as shown on the drawings, including intermediate landing platforms, as indicated on the Drawings and as specified herein, including, but not limited to the following:

1. Prefabricated steel framed stair assemblies with precast concrete step treads, and field poured concrete fill for landings and platforms. Landings and platforms shall receive finish flooring as indicated on the Drawings.

2. Industrial stairs fabricated from steel floor plates and gratings.

3. Prefabricated handrails and railings for stairs together with all fittings, flanges, collars, brackets, bolts, and other items required for a complete installation.

4. Installation accessories.

1.2 REFERENCE STANDARDS

A. References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

1. American Society for Testing and Materials (ASTM).

A36 Standard Specification for Carbon Structural Steel

A48 Standard Specification for Gray Iron Castings

A500 Standard Specification for Cold formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

A501 Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

A568 Standard Specification for Steel, Sheet, Carbon, and High Strength Low Alloy, Hot Rolled and Cold Rolled

A53 Standard Specification for Steel, Black and Hot Dipped, Zinc Coated Welded and Seamless Pipe

A325 Standard Specification for Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength Structural Bolts

A563 Standard Specification for Carbon and Alloy Steel Nuts

E70 Standard Test Method for PH of Aqueous Solutions with the Glass Electrode

E985 Standard Specification for Permanent Metal Railing Systems and Rails for Buildings

2. American Welding Society (AWS).

D1.1 “Structural Welding Code – Steel”

D1.2 “Structural Welding Code – Sheet Steel”

A5.1 “Specification for Carbon Steel Electrodes for Welded Metal Arc Welding”

3. NAAMM

Metal Stairs Manual

Pipe Railing Manual

4. SSPC “Steel Structures Painting Manual, Volume 2, Systems and Specifications”.

1.3 DESIGN REQUIREMENTS

A. Provide steel stairs, landing platforms and treads to support a live load of not less than 100 psf and a concentrated load of 300 lbs. on an area of 4 in^2 whichever produces the greater stress. Limit deflection on length of treads and tread support to 1/8”. Limit deflection of platform support to 1/4”. Limit deflection of stair framing members to 1/8”.

B. Hanger supports for steel stairs shall be either steel tubes or angles as indicated on Drawings. Use of rod hangers is not permitted.

C. Stair framing shall be capable of withstanding stresses resulting from loads specified above as well as stresses resulting from guardrail and railing system loads that are required to meet Section BC 1607.7 of the 2014 NYC Building Code as indicated in paragraphs C and D below.

D. Handrail assemblies and top rail of guard assemblies, and supports, shall be designed to resist the following loads.

1. Uniform load of 50 lb/ft applied in any direction at the top and to transfer this load to the supports.

2. Concentrated load of 200 pounds applied in any direction at any point and to transfer the load to the supports.

3. The uniform and concentrated loads need not be assumed to act concurrently.

E. Infill of Rail Systems: Intermediate rails, balusters, and panel fillers shall be designed to resist the following combination loading. Reactions due to this combination loading are not required to be applied simultaneously with one another and are not required to be superimposed with those in paragraph C above.

1. A concentrated normal load of 50 pounds applied horizontally on an area of 1 ft^2, including openings and spaces between rails.

2. A vertically downward load of 50 lb/ft applied at the most critical locations.

3. A concentrated upward load of 50 pounds applied at the most critical locations.

F. Make design modifications only as may be necessary to meet performance requirements and coordinate the Work. Variations in details which do not adversely affect appearance, durability or strength shall be submitted to the RIOC.

G. Assume all responsibility for the correctness and accuracy of installation, and take and verify all measurements at the Building. The Contractor shall assume full responsibility for the correctness of dimensions and fit.

H. Seismic Performance: Provide metal stairs capable of withstanding the effects of earthquake motions determined according to the NYC Building Code.

I. Tread shall be designed to resist deflection for the stairs. Steel stair and tread manufacturer shall coordinate designs. At a minimum, stair tread pan and riser thicknesses shall be 8 gage. If drawings or calculations require a greater thickness, provide that required to not exceed the maximum indicated deflections.

J. Provide all work and material necessary to comply with requirements of the NYC Building Code for such stairs.

1.4 SUBMITTALS

A. Shop Drawings

1. Submit complete Shop Drawings of all stair work, including precast

concrete treads.

2. Coordinate the steel stair Shop Drawings with the structural steel and reinforced concrete Shop Drawings.

3. All Shop Drawings shall be prepared under supervision of and bear the seal of a New York State Licensed Professional Engineer. Do not submit unchecked shop drawings. First submissions of all drawings shall have one set sealed and signed by the Engineer. After final approval of all shop drawings, submit a final set sealed and signed by the Professional Engineer.

4. Shop drawings will be reviewed by the Engineer of Record for size of material and strength of connections only. This review shall not relieve the Contractor of responsibility for the design of the stairs.

B. Calculations

1. Submit structural calculations and load test data. Calculations shall bear the seal of a professional engineer registered in the State of New York.

C. Manufacturer's Data

Submit manufacturers' catalog data:

1. Paint products

D. Samples

1. Grating, 6"x 6" x 2" thick, representing finish of treads.

E. Certification

Furnish steel manufacturer's certificate certifying welders employed on the Work have met AWS qualifications within the previous twelve months, and for work performed in the field are NYC licensed welders as per Section §28-407.1 of the NYC Administrative Code.

F. Warranty

Manufacturer's warranty.

1.5 QUALITY ASSURANCE

A. Fabricators

Five (5) years minimum experience in steel fabrications of stairs or similar Work.

B. Welding – Shop & Field

Certify that each welder has satisfactorily passed qualification tests for welding processes involved and, if pertinent, has undergone recertification.

C. Comply with requirements specified herein of the New York City Building Code.

D. Engineer Qualification: Professional engineer licensed to practice in New York State and experienced in providing engineering services of the kind indicated that have resulted in the successful installation of stairs similar in material, design and extent to that indicated for this Project.

E. Installer Qualifications: Arrange for installation of steel stairs specified in this section by same firm that fabricated them.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect stairs and all other fabricated items during shipment, storage, erection, and after erection until the Project Work is completed. Protect precast concrete treads to prevent any cracking, chipping of edges, or other damage.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel plate, angles, channels, beams, bars, and other hot-rolled Sections: ASTM A36.

B. Gray Cast Iron Stair Treads

ASTM A48.

C. Seamless Tubular Steel

ASTM A500 for Cold Rolled Tubing ASTM A501 for Hot Rolled Tubing

D. Cold-Rolled Steel Plate

ASTM A568, Grade 36.

E. Steel Pipe (Handrails)

ASTM A53.

F. Bolts

ASTM A325; A563 nuts.

G. Welding Rods

E70 Classification of AWS A5.1.

H. Primer – See Section 09900

Tnemec 10-99 or Benjamin Moore Ironclad Retardo Rust Inhibitive Paint 163.

2.2 INDUSTRIAL STAIRS

A. Industrial stairs to Elevator Machine Room, and at other locations indicated on the Drawings shall be constructed of steel plate or channel strings, checkered steel plate treads, and pipe handrails.

B. Treads shall be checkered steel of standard indent pattern and thickness to satisfy loading criteria; front shall be bent down to form nosing and bent up at back where risers are omitted. Provide top tread of similar material, where indicated on the Drawings.

2.3 PAINTING

A. Remove oil, grease and similar contaminants in accordance with SSPC SP-1 “Solvent Cleaning”, prior to any additional surface preparation specified.

B. Immediately after surface preparation, paint stair work, except the tops of cast iron treads, following manufacturer’s instructions with one shop coat of acrylic rust-inhibitive type containing no lead equal to Tnemec 115 Unibond or Carboline Carbocrylic 3358. Paint must meet SCAQMD standards for VOC emissions.

C. Immediately after erection, fill all open joints with a suitable putty; scrape and sand smooth all bolts and all damaged surfaces of shop coat and all rough surfaces and then touch up with the rust inhibitive primer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate and furnish anchorages, shop drawings, diagrams, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction.

3.2 INSTALLATION

A. Fastening to Construction: Provide sleeves, anchorage devices and fasteners for securing steel stairs including, threaded fasteners for inserts, toggle bolts and through-bolts for setting wall brackets and other required connectors.

B. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of steel stairs. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels, ensure placement of hangers and braces for stabilization of installed assemblies. Provide temporary bracing or anchors for items which are to be built into other work.

C. Place and finish concrete fill for landings and platforms to comply with Division 3 Section "Cast-in-Place Concrete."

1. Coordinate elevations to accommodate finish flooring as indicated on the Drawings.

D. Install concrete treads with full bed of mortar or epoxy mortar as recommended by the manufacturer in additional to mechanical anchorage.

3.3 CONNECTIONS AND OTHER WORK

A. Connections: Fit exposed connections accurately to form tight hairline joints. Weld connections which are not to be left as exposed joints. Grind exposed field welds and joints smooth and touch up abraded shop paint coats. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted field connections.

B. Connect steel stairs to the structural steel framework before concrete and/or sprayed fireproofing is installed. In a reinforced concrete superstructure or portion thereof, secure the steel stairs to the concrete superstructure as indicated on Drawings.

C. For minor connections, such as brackets to strings; bolt treads to risers, using hexagonal nuts where exposed.

D. Other connections

Fillet welds; grind smooth, where exposed.

E. Field Welding: Comply with AWS for procedures of welding, appearance and quality of welds made, and methods used in correcting welding work.

F. Coordination: Coordinate and schedule this work with the work of other trades. Provide soffit clips on stringers required for securing other work, so as to achieve the proper fire rating.

G. Concrete Fill: Provide concrete fill and welded wire fabric for platforms, landings and associated items. Screed, tamp, and finish concrete surfaces as scheduled.

H. Adjust railings for alignment at abutting joints. Space posts as required by design loadings. Plumb posts and secure posts and railing ends as detailed

3.4 TEMPORARY STAIRS

A. If the permanent stairs are to be used as temporary stairs, provide wood treads for protection of the Work.

END OF SECTION 057100

* * *

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide rough carpentry Work as indicated on the Drawings, as required for the completed Work of this Contract, and as specified herein, including, but not limited to, the following:

1. Wood Grounds, nailing strips, blocking, furring, nailers, and framing.

2. Curbs.

3. Rough hardware, including nails, screws, anchors, brackets, braces, bolts, nuts, fittings, and other devices required for the proper fitting, connecting, and erecting of the Work.

4. Rough frames for temporary supports.

5. Fire-retardant treatment for wood.

6. Miscellaneous Lumber.

1.2 REFERENCES

A. References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

1. U.S. Department of Commerce.
   American Softwood Lumber Standard PS 20
   Product Standard PS 1 for Softwood Plywood

2. APA Engineered Wood Association. APA Design/Construction Guide

3. Western Wood Product Association (WWPA).
   Grading Rules

4. Southern Pine Inspection Bureau (SPIB).
   Grading Rules

5. Redwood Inspection Service (RIS).
Grading Rules

6. American Wood Preservers' Association (AWPA).
Standard UC1

7. American Society for Testing and Materials (ASTM).

A575 Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades

E84 Standard Test Method for Surface Burning Characteristics of Building Materials

D226 Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

8. Underwriters Laboratories, Inc. (UL).
UL Test 723

9. Federal Specifications (FS).

10. American Lumber Standards Committee (ALSC).

11. West Coast Lumber Inspection Bureau (WCLIB).
Grading Rules

12. National Fire Protection Association (NFPA).
Test 255 Method of Test of Surface Burning Characteristics of Building Materials

13. Commercial item Descriptions (CIDS)

1.3 SUBMITTALS

A. Quality Control Submittals

1. Certificates: Certification for the following wood treatments:

a. Dip Treatment: Certification by treating plant stating chemical solutions used, submersion period, and conformance with applicable standards.
b. Pressure Treatment: Certification by treating plant stating chemicals and process used, net amount of chemical preservative retained, and conformance with specified standards.

c. Waterborne Preservatives: Certified written statement that moisture content of treated materials was reduced to a maximum of 19 percent prior to shipment to Project site.
d. Fire-Retardant Treatment: Certification by treating plant stating treated material complies with specified standards and treatment will not bleed through specified finishes. Submit BSA or MEA approval certification.

1.4 QUALITY ASSURANCE

A. Mill and Producers Mark

Each piece of lumber and plywood shall be grade stamped indicating type, grade, mill, and grading agency certified by the Board of Review of the American Lumber Standards Committee. Mark shall appear on unfinished surface, or ends of pieces with finished surfaces.

1. Pressure Preservative Treated Material: Accredited agency quality mark on each piece of wood including treatment.

2. Fire-Retardant Treated Material: Accredited testing agency mark on each piece of wood indicating compliance with the fire hazard classification.

B. Standards

Comply with the following unless otherwise specified or indicated on the Drawings:

1. Lumber: American Softwood Lumber Standard PS 20 by the U.S. Department of Commerce. Comply with applicable provisions by each indicated use.

2. Plywood: Product Standard PS 1 for Softwood Plywood, Construction and Industrial by the U.S. Department of Commerce.

3. Plywood Installation: APA Design/Construction Guide, by the American Plywood Association (APA), except as indicated otherwise.

4. Grading Rules:

   a. Douglas Fir, Hem-Fir, Idaho White Pine, and other Western Woods: Western Wood Products Association (WWPA) or West Coast Lumber Inspection Bureau (WCLIB).
   b. Southern Pine: Southern Pine Inspection Bureau (SPIB).
   c. Redwood: Redwood Inspection Service (RIS).

5. Preservative Treatment: American Wood Preservers' Association (AWPA) Standards, quality control methods, and inspection requirements

6. Fire-Retardant Treatment: American Wood Preservers' Association (AWPA) Standards.

C. Regulatory Agencies

1. NYC Board of Standards and Appeals (BSA).

2. NYC Materials and Equipment Acceptance (MEA).

1.5 DELIVERY, STORAGE, AND HANDLING

A. Keep materials dry during delivery. Store materials 6" minimum above ground surface. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and plywood, and provide air circulation between stacks.

B. Cover stored materials until ready for use for protection from moisture. Place and anchor covering in a manner which will assure good ventilation under the covering.

1.6 PROJECT CONDITIONS

A. Correlate location of supporting members to allow proper attachment of other Work as specified in this Section.

PART 2 - PRODUCT

2.1 LUMBER

A. General

Furnish seasoned dimensional lumber dressed to nominal sizes indicated with 19 percent maximum moisture content at time of dressing, marked "S-DRY". Comply with dry size requirements of PS 20.

1. Dress: Surfaced 4 sides (S4S) unless otherwise indicated.

B. Framing Lumber

Species: Douglas Fir (WWPA or WCLIB), or Southern Pine (SPIB), unless otherwise indicated.

Refer to Drawings

1. Light Framing; 2" through 4" thick, less than 6" wide:

   a. Stud Framing Grade: Construction Grade.
   b. Other Light Framing Grade: No. 2.

2. Structural Framing; 2" through 4" thick, 6" and wider:

   a. Grade: No. 1.

C. Board Lumber; less than 2" thick:

1. Exposed Board Lumber, for Paint Finish: Southern Pine No. 1 (SPIB), Douglas Fir 2 Common (WWPA) or Select Merchantable (WCLIB), or Redwood Construction Common (RIS).

2. Exposed Board Lumber, for Transparent Finish: Redwood Clear (RIS).

3. Concealed Board Lumber: Southern Pine No. 3 (SPIB), any species No. 4 (WWPA) or any species Standard (WCLIB), or Redwood Merchantable (RIS).

D. Miscellaneous Lumber

Standard grade, No. 3 grade, or better grade of the following species unless otherwise indicated:

1. Nailers and Blocking: Douglas Fir, Hem-Fir, Idaho White Pine or Southern Pine.

2. Furring: Douglas Fir or Southern Pine.

3. Plaster Grounds:

   a. Interior Use: Douglas Fir or Southern Pine.
   b. Exterior Use: Western Red Cedar or Redwood.

4. Floor Sleepers: Western Red Cedar or Redwood Construction Heart.

5. Door and window Bucks: Western Red Cedar or Redwood.

2.2 PLYWOOD

A. Roof and Wall Sheathing and Subflooring: APA RATED SHEATHING, EXPOSURE 1. Furnish APA PS 1 veneered panels, with span ratings for the required thicknesses as listed below unless otherwise indicated.

Thickness	Span Rating
3/8"	24/0
1/2"	32/16
5/8"	40/20
3/4"	48/24

B. Underlayment

APA UNDERLAYMENT, EXPOSURE 1.

1. For use under resilient tile flooring and resilient sheet flooring: Sanded face.

2. For use under carpet and "liquid" flooring: Touch-sanded.

C. All plywood used within the weatherproofing/waterproof membrane (interior) of the building shall contain no added urea- formaldehyde. This requirement applies to plywood roof and wall sheathing.

2.3 MISCELLANEOUS MATERIALS

A. Underlayment Patching Compound

Hardsetting, quicksetting type with latex or polyvinyl acetate binder.

B. Asphalt Felt

Asphalt-saturated felt, No. 15, without perforations, complying with ASTM D226.

C. Rosin Paper

Commercial, rosin-sized building paper, 0.010" thick.

D. Hardboard

PS 58, Class "Tempered, S1S, plainboard.

E. Adhesive

APA Specification AFG-01. For adhesive used on site and within the weatherproofing/waterproof membrane (interior) of the building, comply with V.O.C. requirements specified in Section G01600.

2.4 PRESERVATIVE TREATMENT

A. Treat lumber and plywood where indicated and as specified. Comply with applicable AWPA Standards and quality control and inspection requirements.

1. Fasteners and anchoring devices to be used with wood treated with waterborne preservatives shall be hot-dip galvanized or stainless steel if the wood will be exposed to moisture.

B. Complete fabrication of items to be treated to the greatest extent possible, prior to treatment. Where items must be cut after treatment, coat cut surfaces with heavy brush coat of the same chemical used for treatment or other solution recommended by AWPA Standards for the treatment.

C. Inspect wood after treating and drying. Discard warped or twisted items.

D. Pressure Treatment (Above Ground Use)

Treat the following wood items with waterborne preservatives for above ground use, complying with . AWPA Standards T1-T10. Redry wood to a maximum moisture content of 19 percent after treatment.

1. Nailers, blocking, cants, shim stock, and similar members used in conjunction with roofing (including related flashings, trim and vapor barrier), coping, and waterproofing.

2. Nailers, blocking, furring, stripping, and similar concealed members in contact with exterior masonry and concrete (including interior wythe of exterior walls), and all sills for framing.

3. Wood items indicated or scheduled on the Drawings to be preservative treated.

E. Pressure Treatment (Ground Contact Use)

Treat the following wood items with waterborne preservatives for below ground use, complying with AWPA Standards T1-T10.

1. Wood members placed in the ground.

2. Wood members immersed in fresh water.

2.5 FIRE-RETARDANT TREATMENT

A. Where lumber is indicated or required to be fire-retardant treated, provide "UCFA" lumber, complying with AWPA Standards for pressure impregnation with

fire-retardant chemicals to achieve a flamespread rating of 25 or less, when tested in accordance with UL Test 723, ASTM E84 or NFPA Test 255.

1. Where treated items are indicated to receive a transparent or paint finish, use a fire-retardant treatment which will not bleed through or adversely affect bond of finish.

2. Provide UL label or identifying mark on each piece of fire-retardant lumber.

3. Redry treated items to a maximum moisture content of 19 percent after treatment.

B. Fire-retardant Treated Plywood

Comply with APA requirements.

2.6 FRAMING HARDWARE

A. Fasteners and Anchoring Devices

Provide items of type, size, style, grade, and class as required for secure installation of the Work. Items shall be galvanized for exterior use. Unless shown or specified otherwise, comply with the following:

1. Nails and Staples: ASTM F1667

2. Wood Screws: FS FF-S-111D.

3. Bolts and Studs: FS FF-B-575C.

4. Nuts: FS FF-N-836E.

5. Washers: FS FF-W-92B.

6. Lag Bolts or Lag Screws: ASME/ANSI B18.2.1

7. Masonry Anchoring Devices: Expansion shields, masonry nails and drive screws: CIDS A-A-1925A, A-A-55614, A-A-55615

8. Bar or Strap Anchors: ASTM A575 carbon steel bars.

9. Wall Plugs: Corrugated type, galvanized steel, 24 USS gauge min, not less than 2" wide x 2½" deep.

10. Cross Bridging: Nailable type, galvanized steel, 16 USS gauge min, by 3/4" wide.

11. Metal Hangers and Framing Anchors: Size and type for intended use, galvanized finish, manufacturer's recommended fasteners.

12. Buck Anchors: Corrugated type, galvanized steel not lighter than 12 USS gauge min, 4" wide (except where partitions are less than 4" thick) by 8" long, punched for two 5/16" carriage bolts at buck end.

13. Sleeper Anchors: Approved type, galvanized steel not lighter than 20 USS gauge min, not less than 1¼" wide, designed to anchor into concrete not less than 1½" and permit height adjustment of sleeper.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions

Examine substrate and supporting structure on which rough carpentry is to be installed for defects that will adversely affect the execution and quality of the Work. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION - GENERAL

A. Do not use units of material with defects which impair the quality of the Work and units which are too small to fabricate the Work with minimum joints or with optimum joint arrangement.

B. Install Work accurately to required lines and levels with members plumb and true, accurately cut and fitted and securely fastened. Closely fit rough carpentry to other associated construction.

C. Securely attach carpentry Work to substrates by anchoring and fastening as indicated, or, if not indicated, as required by the referenced standards. Select fasteners of size that will not penetrate through members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required. Set nail heads in exposed Work which is to be painted or stained and fill resulting holes.

D. Fire-retardant Treated Wood

1. Do not rip or mill; only end cuts, drilling holes and joining cuts shall be permitted.

2. Where material is cut to length, shaped or grooved after treatment, surfaces thereby exposed shall be protected by tightly butting them against noncombustible or fire-retardant treated material, in accordance with the NYC Building Code. Drilled holes shall be covered with tightly fitting noncombustible cover plates.

3.3 WOOD FRAMING

A. Install framing members of nominal sizes indicated or of units built-up to dimensions indicated, on spacings shown. Construct required openings for installation of related work. Do not splice structural members between supports.

B. Anchor and nail members as indicated. If not included, comply with recommendations of the NFPA.

C. Install miscellaneous blocking and framing indicated and as required for attachment and support of facing materials, fixtures, specialty items, and trim.

D. Stud Framing

Install stud framing indicated. Unless otherwise shown, use 2" x 4" wood studs spaced 16" o.c with 4" face perpendicular to direction of wall or partition. Install single bottom plate and double tip plates 2" thick by width of studs; except single top plate may be used for non-load-bearing partitions. Nail or anchor plates to supporting construction.

1. Construct corners and intersections with not less than 3 studs. Frame openings with multiple studs and headers. Install nailed header members of thickness equal to width of studs.

2. Install diagonal bracing in exterior wall stud framing unless otherwise indicated. Brace both walls at each external corner, full story height, at 45 degree angle. Use either a let-in 1" x 4" board or 2" x 4" blocking.

E. Joist Framing

Install framing of sizes and on spacings shown. Install with crown edge up and support ends of each member with not less than 1½" of bearing on wood or metal, or 3" on masonry. Attach to wood bearing members by toe nailing or metal connectors; frame to wood supporting members with wood ledgers or with metal connectors. Fire-cut members built into masonry (if any). Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceed 4 feet. Do not notch in middle third of joists; limit notches to 1/6-depth of joist, 1/4 at ends. Do not bore holes larger than 1/3-depth of joist or locate closer than 2" from top or bottom. Install solid

blocking (2" thick by depth of joist) at ends of joists unless nailed to header or band member.

1. Lap members framing from opposite sides of beams, girders or partitions not less than 4" or securely tie opposing members together. Install solid blocking (2" thick by depth of joist) over supports.

2. Anchor masonry bearing members with 1/4" x 1¼" metal strap or "T" anchors with wall ends bent 4" at every second joist. Extend anchors not less than 1'-4" along bottom of joist end and nail.

3. Anchor members paralleling masonry with 1/4" x 1¼" metal strap anchors spaced not more than 8 feet o.c. Extend anchors at least 4" into masonry, turn up 4" and extend over and fasten to 3 joists.

4. Install solid blocking between joists under jamb studs at openings.

5. Under non-load-bearing partitions, install double joists separated by solid blocking equal to depth of studs above.

    a. Install triple-joists separated as above, under partitions receiving ceramic tile and similar heavy finishes or fixtures, unless otherwise shown.

F. Install bridging between joists where nominal depth-to-thickness ratio exceeds 4, at intervals of 8 feet.

3.4 WOOD NAILERS, BLOCKING, AND GROUNDS

A. Install required items where indicated and where required for support, attachment or screeding of other Work. Form to shapes indicated or required. Coordinate locations and cut and shim as required to provide items at true and level planes to receive Work to be attached. Install closure strips to nailers at all edges.

1. Attach to substrates as indicated; if not indicated, size and space fasteners as required to support applied loading. Maximum spacing of fasteners shall not exceed 16". Unless otherwise shown on the Drawings, install and secure material to non-wood construction as follows:

    a. To Concrete: Attach material less than 1½" thick with screws and non-ferrous metal expansion shields. Attach materials 1½" and thicker with machine bolts and non-ferrous metal compound type anchors.
    b. To Concrete Unit Masonry: Attach material to new masonry with annular ring nails driven into wall plugs where fastening occurs at joints of masonry or with special hardened steel masonry nails where fastening occurs in the masonry units. Attach material to

existing masonry with machine screws and non-ferrous metal expansion shields where fastening occurs in solid portions of masonry. If fastening occurs at cells of masonry, secure material in place with toggle bolts.

c. To Brick Masonry: Attach material to new masonry with annular ring nails driven into wall plugs. Attach material to existing masonry with machine screws and non-ferrous metal expansion shields.

d. To Steel: Attach material with galvanized bolts and nuts or stainless steel machine screws tapped into the metal, as required by conditions.

e. To Non-Ferrous Metal: Attach material with stainless steel or other approved non-ferrous metal bolts and nuts or self-tapping screws, as required by conditions.

2. Counter-sink bolts and nuts flush with surfaces, unless otherwise shown. Build into masonry during installation of masonry Work. Where possible, anchor to formwork before concrete placement. Bevel both edges of members to be anchored in concrete. Shims shall be cedar shingles or redwood wedges.

3. Install permanent grounds of dressed, preservative treated, key beveled lumber not less than 1½" wide and of the thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

4. The grounds for coat hook and bracket strips in wardrobe cabinets shall be attached to partitions with toggle bolts and to brick walls with expansion bolts before any plastering is done.

3.5 PLYWOOD SHEATHING, SUBFLOORING, AND UNDERLAYMENT

A. Comply with printed installation requirements of the APA Design/Construction Guide, for plywood application required, unless otherwise indicated.

B. Plywood Underlayment

Install underlayment just prior to installation of finish flooring. Stagger end joints between panels in relation to each other and stagger all joints in relation to substrate jointing. Allow 1/32" space between panel ends and edges for expansion. Fasten in accordance with APA recommendations. Prior to installation of finish flooring, patch damaged areas wider than 1/16". Set nails 1/16", but do not fill. Sand rough areas smooth, and uneven joints flush. Fasteners must be flush with the surface of the subfloor.

C. Roof Sheathing

Install panels with face grain across supports. Provide supports at edges by use of clips, wood blocking, or T. & G. panels. Allow 1/16" spacing at panel ends; 1/8" spacing at edges.

Nail 6" o.c along edges and 12" o.c at intermediate supports.

D. Wall Sheathing

Allow 1/16" spacing at panel ends and 1/8" spacing at edges.

Nail 6" o.c along panel edges and 12" o.c at intermediate supports.

E. Subfloor

Install panels continuous over two or more spans, with face grain across supports. End joints shall occur over supports. Allow 1/16" spacing at panel ends and 1/8" at edges.

Before placing panels, apply continuous line of adhesive on joists.

F. Nails

Common.

For plywood thickness to 1/2": 6d.

For plywood thickness greater than 1/2": 8d.

3.6 PROTECTION OF STONEWORK

A. The top surfaces, projections, door jambs, sills, steps, ornamental work, of exterior stonework, where liable to damage, shall be protected by temporary boxing. Furnish and set boxing, using only galvanized nails, as soon as the stonework is set and maintain the boxing until the stonework is cleaned down. No material shall be used which will stain or damage the stonework.

3.7 ROUGH HARDWARE

A. Furnish and install all rough hardware, such as nails, bolts, buck anchors, clips, (including expansion and carriage bolts for wall seats, wardrobe brackets, etc.), and all other rough hardware required to secure the carpentry work in place, unless otherwise specified.

END OF SECTION 061000

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SECTION 071150 - SHEET MEMBRANE WATERPROOFING FOR FOUNDATIONS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide sheet membrane waterproofing for foundation walls and slabs as indicated on the Drawing and as required for a complete watertight installation.

1.2 RELATED SECTIONS

A. Earthwork.....Section 022010

B. Cast-In-Place Concrete .....Section 033000

1.3 REFERENCES

References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

A. American Society for Testing and Materials (ASTM)

B. Federal Specifications (FS)

1.4 DESIGN CRITERIA

A. Waterproofing system shall be complete and consist of all liquid membranes, protection boards, drainage panels, tapes, and other material required for the system to be watertight. System shown on Drawings and specified herein is based on Grace Construction Products materials. Other manufacturers listed are acceptable if they have a complete system that meets the performance requirements of this specification. Regardless of manufacturer used, the Contractor is responsible for providing a complete system and shall discuss with manufacturer prior to bid.

B. The Grace polyethylene membrane (Preprufe) used on the underside of slabs may not require the use of a mud mat. If other systems are used, the use of a mud mat is required. It is also to be used for blind side applications where lagging or formwork is not to be removed. The Carlisle butyl rubber membrane (.120 Butyl) requires protection board on each side as a minimum. Mud mat, protection board,

and any additional detailing required by the Architect/Engineer of Record to provide for the proper installation of the membrane shall be at no cost to the RIOC.

1.5 SUBMITTALS

A. Submittals (General)

Submit the Shop Drawings, product data, and samples specified below at the same time, as a package.

B. Product Data

1. Catalog sheets, Specifications, and installation instructions for each material specified.

2. Revise the membrane manufacturer's standard details as necessary to suit the requirements of the Contract Documents. Manufacturer's details are not to routinely be used for the Work of this Contract.

a. Unless approved otherwise in writing by the RIOC, the requirements of the Contract Documents take precedence over the manufacturer's standard specifications and details where they are more restrictive. Any discrepancies affecting the warranty by the manufacturer are to be brought to the RIOC'S attention.
b. Any materials, installation procedures, or details not included in the Contract Documents must be approved by the Architect/Engineer of Record.

C. Shop Drawings

When there is a proposed deviation from the Contract Documents, submit revised details, labeled as such, for approval. The revised detail shall show existing conditions and shall be referenced directly to the related details on the Contract Drawings. Details not shown on the Contract Drawings shall be as recommended by the waterproofing manufacturer and approved by the Architect/Engineer.

D. Samples

1. Drainage panel

E. Quality Control Submittals

1. Certificates: Furnish manufacturer's certification that materials meet or exceed specification requirements.

2. Manufacturer's Field Reports: Submit copies of inspection reports.

3. Intent to Warranty/Guarantee

   a. Manufacturer's Warranty Sample: Submit a sample copy of the membrane manufacturer's five (5) year materials warranty.
   b. Intent to guarantee document from the installer with a performance guarantee against water penetration through waterproofing system for 5 years with any necessary replacement material and labor supplied at no cost to RIOC.

4. Qualifications

   Provide proof of Manufacturer and Installer qualifications and experience specified under “Quality Assurance”.

F. Warranty

1. Manufacturer's Warranty: Upon acceptance of the completed Work of this Section, furnish the membrane manufacturer's written five (5) year materials warranty.

2. Contractor's written five (5) years guarantee covering materials and workmanship.

1.6 QUALITY ASSURANCE

A. Qualifications

1. Membrane Manufacturer

   a. The manufacturer must have been actively marketing a self-adhering rubberized asphalt sheet membrane waterproofing system in the United States for a minimum of three (3) years.
   b. The manufacturer's rubberized asphalt sheet membrane must have previously been installed on a minimum of 10 waterproofing projects of comparable scope and complexity to the Work of this Section.

2. Applicator

   a. The waterproofing applicator must have been actively installing waterproofing systems for the past five (5) years and shall be certified by the manufacturer to install their system.
   b. The waterproofing applicator must have previously installed and completed a minimum of five (5) waterproofing projects of comparable scope, specified system, and complexity to the Work of this Section.

c. The person supervising the Work of this Section and the workers applying the waterproofing materials shall have had at least three (3) years of experience in the application of waterproofing materials.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery

Deliver all materials to the site in the manufacturer's labeled, unbroken containers. Membrane rolls must be packaged in rigid containers to prevent membrane distortion.

B. Storage

1. Do not double stack pallets of membrane.

2. Store all materials on wooden platforms in a well-ventilated place.

3. Store drainage panel and protection board flat.

4. Cover all materials on top and sides with tarpaulins allowing for adequate ventilation. Keep materials dry at all times.

5. Store all materials away from high heat, flames, and sparks.

C. Handling

1 Handle all materials in a manner to prevent damage. Mark and remove all damaged material from the site.

2. Do not smoke or use open flames near primer, mastics, or liquid membrane.

1.8 PROJECT CONDITIONS

A. Do not execute the Work of this Section without notifying the RIOC's Representative at least five (5) days before commencing.

B. Do not execute the Work of this Section unless the substrate is smooth, dry, and free of all dirt, dust and debris. Concrete shall be cured 28 days minimum prior to installing material.

C. Unless approved otherwise by the RIOC, do not execute the Work of this Section when the air or surface temperature of the structural substrate is below 30°F.

D. Install waterproofing only when groundwater is being maintained below the waterproofing level.

E. Do not apply the waterproofing system in areas where dust is being generated from adjacent work areas.

F. Do not leave polyethylene type membrane exposed for more than 30 days and the rubberized asphalt type membrane for more than 60 days.

1.9 WARRANTY AND GUARANTEE

A. Warranty

The Contractor shall provide, from the membrane Manufacturer, a written 5-year warranty for the materials used in the membrane application, providing for replacement of defective material.

B. Guarantee

The Contractor shall furnish a written five (5) year guarantee, providing that the membrane materials and workmanship will be free from leaks and defects; and that if leaks and defects do occur, the membrane system and all other work damaged by the failure, including Work which must be removed for access to the waterproofing materials, will be repaired or replaced at the Contractor's expense.

PART 2 - PRODUCT

2.1 MANUFACTURERS

A. Waterproofing Membrane

1. Grace Construction Products, Cambridge, MA.

2. SOPREMA, Inc., Wadsworth, OH

3. Northern Elastomeric Inc. (NEI) Brentwood, NH 03833

B. Prefabricated Drainage Panel

1. Grace Construction Products, Cambridge, MA.

2. Mirafi, Inc., available locally through Ragan Associates, Edison, N.J.

3. Carlisle Coatings and Waterproofing, Sapulpa, OK

2.2 MATERIALS

A. Wall and Slab Sheet Membrane Waterproofing

Self-adhesive, cold-applied composite sheet consisting of rubberized asphalt with cross-laminated polyethylene film permanently bonded to the outer surface.

1. Physical Properties

a. Flexibility - ASTM D1970 (180 degrees bend over one-inch mandrel at -45 degrees F): Unaffected.
b. Tensile Strength - ASTM D412, Die C modified: 325 psi minimum
c. Tensile Strength, film - ASTM D882: 5000 lb/in^2
d. Elongation (Rubberized Asphalt) - ASTM D 412 (Die C) modified: 300 percent minimum.
e. Cycling Over Crack at -25 degrees F - ASTM C836: No effect 100 cycles.
f. Puncture Resistance - ASTM E154: 40 pounds minimum
g. Permeance - ASTM E 96 method B: 0.05 perms maximum
h. Water Absorption - ASTM D570: 0.1 percent maximum
i. Total Membrane Thickness - ASTM D3767, Method A: 60 mils nominal
j. Peel Strength - ASTM D1876: 5 lb/in.
k. Resistance to Hydrostatic Head - ASTM D5385: 231 ft of water

2. Material shall be Bituthene 4000 by Grace Construction Products or approved equal.

B. Slab Sheet Membrane Waterproofing (Also for blind side formwork application)

Cold-applied composite sheet consisting of high-density polyethylene film, synthetic adhesive, and protective coating. Material is placed such that concrete is cast against the protective coating.

1. Physical Properties

a. Flexibility - ASTM D1970 (180 degrees bend over one-inch mandrel at -10 degrees F): Unaffected.
b. Tensile Strength, film - ASTM D882: 5000 lb/in^2
c. Elongation (Rubberized Asphalt) - ASTM D 412 (Die C) modified: 300 percent minimum.
d. Cycling Over Crack at -10 degrees F - ASTM C836: No effect 100 cycles.
e. Puncture Resistance - ASTM E154: 180 pounds minimum
f. Permeance - ASTM E 96 method B: 0.01 perms maximum
g. Water Absorption - ASTM D570: 0.5 percent maximum

h. Total Membrane Thickness - ASTM D3767, Method A: 56 mils nominal
i. Peel Adhesion to Concrete - ASTM D903 Modified: 5 lb/in.
j. Resistance to Hydrostatic Head - ASTM D5385 Modified: 231 ft of water

2. Material shall be Preprufe 300R by Grace Construction Products or approved equal.

C. Slab Sheet Membrane Waterproofing

Cold-applied membrane consisting of butyl rubber.

1. Physical Properties

a. Flexibility - ASTM D1970 (180 degrees bend over one-inch mandrel at -10 degrees F): Unaffected.
b. Tensile Strength, film - ASTM D882: 1200 lb/in^2
c. Elongation (Rubberized Asphalt) - ASTM D 412 (Die C) modified: 300 percent minimum.
d. Cycling Over Crack at -10 degrees F - ASTM C836: No effect 100 cycles.
e. Puncture Resistance - ASTM E154: 180 pounds minimum
f. Permeance - ASTM E 96 method B: 0.01 perms maximum
g. Water Absorption - ASTM D570: 0.5 percent maximum
h. Total Membrane Thickness - ASTM D3767, Method A: 120 mils nominal
i. Peel Adhesion to Concrete - ASTM D903 Modified: 5 lb/in.
j. Resistance to Hydrostatic Head - ASTM D5385 Modified: 231 ft of water

2. Material shall be .120 Butyl by Carlisle Coatings and Waterproofing or approved equal.

D. Related Products

Provide the following component accessories to the waterproofing system:

1. Manufacturer's Liquid Membrane

2. Bituthene Preprufe Tape where required for Grace products.

3. Hydroduct Tape where required for Grace products.

4. Manufacturer's Concrete Primer

5. .120 Butyl accessories where required by Carlisle Coatings and Waterproofing.

E. Prefabricated Drainage Panels

1. General

Prefabricated drainage panel shall be a composite system consisting of a non-woven geotextile drainage fabric bonded to a three-dimensional, highly impact resistant plastic core with high strength backing film acceptable to the membrane manufacturer.

2. Plastic Core

The core shall have the following minimum physical properties:

a. Compressive strength (ASTM D1621)....15000 psf
b. Flow (gradient 0.1,37.9 Kpa - ASTM D4716).....15 gpm/ft of width
c. Thickness (ASTM D1777).....3/8"
d. Weight (ASTM D3776).....2.9 oz/ft^2
e. Overlaps: Shall be capable of mechanical interlocking so as to prevent separation of the overlaps during backfill.

3. Filter Fabric: The filter fabric shall be a nonwoven geotextile fabric having the following physical characteristics:

a. Equivalent opening size COE CW02215.....70-100
b. Burst strength (ASTM D3786).....270 psi
c. Permeativity (ASTM D4491).....140 gpm/ft^2
d. Puncture strength (ASTM D4833).....65 lbs
e. Weight (ASTM D3776).....4.0 oz/yd^2

The fabric shall be uniformly bonded to the core, so as to resist being pushed into the flow channels of the core during backfilling. The fabric to core bond shall use pressure sensitive adhesive, and the fabric shall extend beyond the edge of the core, so that the fabric can be adhered in the field across all core overlaps.

4. Product

a. Hydroduct 220 Drainage Composite by Grace Construction Products.
b. Miradrain 6000/6200 by MiraDri Moisture Protection Products.
c. Sure-Drain V-2 by Carlisle Coatings and Waterproofing.

2.3 PRE-INSTALLATION CONFERENCE

A. Prior to the start of the waterproofing and concrete construction schedule, the Contractor shall conduct a meeting to review the proposed waterproofing design and to discuss the required methods and procedures to achieve the required quality and waterproofing integrity. The meeting shall include, at a minimum, the membrane installer, membrane manufacturer, concrete and rebar installer, electrical and plumbing work installers, and the RIOC's Construction Manager and CID Inspector. The Contractor shall send a conference agenda to all attendees prior to the scheduled date of the conference.

PART 3 – EXECUTION

3.1 EXECUTION PROCEDURES

A. The preparation and application procedures in Article 3.02 and Article 3.03 are general; follow the membrane manufacturer's recommendations as required to obtain the five (5) year warranty and the five (5) year guarantee. Notify the Architect of discrepancies.

3.2 INSPECTION AND PREPARATION

A. Do not begin application of membrane waterproofing until all cracks, honeycombs, loose aggregate, sharp protrusions, tie holes, etc. have been repaired, fins removed, and the surface is free of contaminants such as oil, grease, dust, and other foreign materials. Refer to Section 03300 for repair of the items.

B. Concrete substrate shall be cured a minimum of 7 days for rubberized asphalt membrane or longer if required by membrane manufacturer.

C. Application of the membrane to any substrate shall constitute acceptance of that substrate by the membrane manufacturer and installer as suitable to receive the Work.

D. Apply additional 8" wide strip of membrane over construction joints, cold joints, control joints, and expansion joints.

3.3 MEMBRANE APPLICATION

A. Polyethylene (Preprufe) Membrane Slab Application

1. Preprufe membrane can be placed directly on suitably prepared grade. Grade is to have no sharp objects and shall be acceptable to the membrane manufacturer. Membrane shall be supported on footing formwork at sides. It is also to be used for blind side vertical applications where lagging or formwork is not to be removed. Follow manufacturers recommended lap details. At end lap, provide 3" lap and preprufe tape centered over the end lap. Cut laps to be sealed with liquid membrane covered with tape.

2. Follow all manufacturer's recommendations for slab penetrations. Apply liquid membrane waterproofing, lapping material with the Preprufe membrane and around all penetrations. Install Preprufe tape as per manufacturer's recommendations.

3. Reinforcing chairs and other items supporting reinforcement shall be flat or have flat runners as described in Section 03200 so as not to puncture the membrane. Verify suitability or material with membrane manufacturer.

B. Rubberized Asphalt Membrane Slab Application.

1. Material is to be placed on working slab and supported on footing formwork at sides. Follow manufacturers recommended lap details. At end lap, provide 3" lap. Cut laps to be sealed with liquid membrane.

2. Follow all manufacturer's recommendations for slab penetrations. Apply liquid membrane waterproofing, lapping material with the membrane. Apply additional flashings if required.

3. Install protection board upon approval of the membrane installation and prior to placement of reinforcement. Do not allow membrane to be punctured.

C. Walls

1. After concrete walls are poured and have cured a minimum of 7 days (or greater as otherwise recommended by the membrane manufacturer), apply primer to the substrate at the rate recommended by the membrane manufacturer; apply primer only to areas which can be covered that same day. All joints are to be done first by applying primer only at the joints and installing the coverstrips.

2. After primer is tack free, apply rubberized asphalt membrane, lapping edge seams a minimum of 3", and end seams a minimum of 4"; apply wall membrane to form lap with slab membrane and up walls to elevation

indicated. Seal ends with liquid membrane waterproofing up adjoining walls. Stagger lap ends.

3. Seal all membrane edges, terminations, and pipe penetrations thoroughly with liquid membrane.

D. Waterstops shall be adhered to the membrane waterproofing with manufacturer's recommended adhesive. Refer to Section 03300 for waterstop materials.

E. Apply double plies of sheet membrane around drains, pipes, and other penetrations; extend 6" horizontally in all directions. Seal terminations thoroughly.

F. Install drainage panel over membranes upon inspection as indicated on Drawings. Membranes and drainage panels are not to be exposed for more than 7 days.

3.4 PREFABRICATED DRAINAGE PANEL

A. General

1. Position the panel with the filter fabric toward the soil. Use manufacturer's recommended adhesive.

2. Install panel as shown on Drawings. Panel shall run from one foot below grade to bottom of footings, providing complete protection of wall membrane waterproofing.

B. Overlaps

Peel the fabric back from the attached panel to expose 3" of core. Overlap the core of the next panel by 2" and interlock. Re-attach the fabric to completely cover the core overlap. Shingle each course, overlapping both the core and the fabric in the direction of water flow.

C. Terminal Connections and Protrusions

Cover all terminal edges with the integral fabric flap by cutting the core back approximately 4" and tucking the fabric around the edge of the core and secure it. At protrusions, cut the core around the protrusion, cut an "X" in the fabric, and tape the fabric around the protrusion. Dirt, plastic, and concrete must not be allowed to infiltrate the core.

3.5 FIELD QUALITY CONTROL

A. Membrane Manufacturer Inspection

1. Notify the manufacturer of the waterproofing materials in sufficient time, but not less than 3 days, prior to start of each portion of the work to allow for inspection of substrates and membranes. The membrane manufacturer shall visit the site as needed to review installation and provide a field report to the GC and the RIOC. All joints shall be thoroughly inspected prior to concrete placement or the product being covered with other materials.

2. Contractor shall pay for all services by the manufacturer. Work shall be done to the manufacturer's and the RIOC's satisfaction.

B. RIOC Inspection

Notify the RIOC in sufficient time, but not less than 3 days, prior to start of each portion of the work to allow for inspection of substrates and membranes by RIOC.

3.6 PROTECTION

A. Provide protection for membrane as recommended by the manufacturer, before and during placement of concrete over membrane. Protect membrane and drainage panel before and during backfilling and replace any membrane or drainage panel damaged during the backfilling operation.

B. Place backfill within 7 days. Avoid damaging the panels, insulation, or protection board with the compactor's hoe, exhaust, or tamper foot. Replace any damaged fabric or panels.

3.7 REMEDIATION

A. Contractor is responsible for providing a watertight structure. Provide all required remediation for any leakage that may occur with products and methods acceptable to the RIOC.

END OF SECTION 071150

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SECTION 072600 - INTUMESCENT FIRE-RESISTANT COATING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide material, labor, equipment, services to properly install intumescent fire-resistant coating (intumescent fireproofing) on steel framing members and assemblies as indicated on the Drawings at a thickness that will meet the required fire-resistance rating of the New York City Building Code of the 2014 NYC Building Code for Construction Classification Class IB.

B. All steel to receive intumescent fireproofing is to be primed as specified in Section 051200, with exterior and cavity wall application to receive zinc metallizing prior to priming. All fireproofing is to receive a finish coat as specified in section 09900. Finish coat for the exterior and cavity wall application must provide the indicated abrasion resistance if the coating has not been tested or meets the indicated value. All primer and finish coats are to be acceptable to the intumescent fireproofing manufacturer.

C. Intumescent fireproofing is to have a smooth, even finish appearance acceptable to the Architect of Record.

1.2 RELATED SECTIONS AND WORK

A. Structural Steel.....Section 051200

B. Painting.....Section 099000

1.3 REFERENCES

References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

A. American Society of Testing and Materials (ASTM) standards, latest editions:

D2240 Standard Test Method for Rubber Property—Durometer Hardness.

D2794 Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

D3960 Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.

D4060 Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.

D4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

E84 Standard Test Method for Surface Burning Characteristics of Building Materials

E119 Standard Test Methods of Fire Tests of Building Construction and Materials

B. Underwriters Laboratories Inc. (UL) Fire Resistance Directory (Latest Edition)

UL/ANSI 263 Fire Tests of Building Construction Materials

C. Association of the Wall and Ceiling Industry (AWCI)

AWCI Technical Manual 12-B: Standard Practice for the Testing and Inspection of Field Applied Thin-Film Intumescent Fire-Resistive Materials

1.4 PERFORMANCE REQUIREMENTS

A. Thickness of intumescent fireproofing shall be such to provide required fire rating in accordance with the NYC Building Code and Drawings. Thicknesses shall be based on unrestrained assemblies. Ratings are shown on Drawings for members and assemblies.

B. Fire-resistance rating shall be:

a.	Columns Supporting More Than One Floor…..	2 hours
b.	Columns Supporting Only One Floor.....	2 hours
c.	Bracing members.....	Match Adjacent
d.	Beams connected to columns (members that are part structural frame)	2 hours
e.	Beams Supporting more than One Floor……..	2 hours
f.	Structural Members Supporting a Fire Rated Wall or Partition.....	2 hours
g.	Floor Construction (Including Beams - those members not part of the structural frame).....	2 hours
h.	Roof Construction (Including Beams - those members not part of the structural frame).....	0 hours

1.5 SUBMITTALS

A. Product Data

Submit manufacturer's product information for each type of material including application instructions and specifications.

B. Samples

Provide color samples of each material to show material matches that of finish coats.

C. Quality Control Submittals

1. Design Data

a. For each type of material, submit thickness of material required to give the proper fire rating for each type of assembly or individual member (such as inner angle of lintel assemblages, bracing members, columns, etc.) as prepared by the manufacturer.
b. For assemblies having limiting ratios such as W/D, submit table from the manufacturer listing the member, W/D ratio, and the thickness of material required to give the required fire rating. Ratings shall be based on unrestrained assemblies. Provide manufacturer with complete set of Drawings to enable correct determination of required thickness for all members and assemblies.
c. From list prepared by manufacturer, provide mark-up of framing plans indicating thickness and type of material for each member.

2. Certificates

a. Furnish manufacturer's certification that materials meet or exceed specification requirements for each of the performance tests specified in Part 2.
b. Furnish applicator's certification that material has been completed as specified to meet fire resistance ratings, thickness requirements, and application requirements.

c. Furnish UL, BSA, MEA, or OTCR approval of material.
d. Furnish certificate stating each material is 100% asbestos free.

3. Contractor Qualifications

Provide proof of Manufacturer and Applicator qualifications specified under "Quality Assurance".

D. Guarantee

1. Contractor and installer's installation guarantee.

1.6 QUALITY ASSURANCE

A. Qualifications

1. Manufacturer: Company specializing in the manufacture of intumescent fireproofing to be used in this Contract shall have a minimum of five years of fire protection experience.

2. Applicator: Company specializing in the application of intumescent fireproofing shall have a minimum of three years experience and shall have worked on at least two projects with similar quantities and type of materials used. Applicator shall be acceptable to the intumescent fireproofing manufacturer.

B. Regulatory Requirements

1. Building Code: Material and application shall meet the requirements for fire resistance ratings for areas to receive the intumescent fireproofing in accordance with the NYC Building Code.

2. Material must have UL or NYC BSA, MEA or OTCR approval for each fire-tested assembly utilized.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, unopened packages bearing name of manufacturer, product identification, and the proper UL labels for fire hazard and fire-resistance classification.

B. Reject damaged packages found unsuitable for use and remove from job site.

C. Store materials off ground and under cover away from direct sunlight at temperatures between 50ºF (10ºC) and 90°F (32C).

D. Keep materials dry at all times. Wet material shall be discarded.

E. Rotate stock material and use prior to expiration date.

1.8 ENVIRONMENTAL REQUIREMENTS

A. At time of application, the ambient air and steel temperatures should be at or above 50°F (10°C) and not exceed 100°F (38°C). An ambient air temperature at or above 50°F (10°C) must be maintained for the 48 hour period after application. When necessary, provide enclosures to maintain temperature within specified range.

B. Relative humidity shall not exceed 80% throughout the total period of application and drying for the intumescent fire resistive material, as well as the application and drying for the protective decorative topcoat

C. The surface temperature of the steel must be a minimum of 5°F (3°C) above the dew point to prevent condensation from forming on the steel. Do not apply material if condensation is present.

D. Provide ventilation in areas to receive fireproofing during and 72 hours, minimum, after application, to dry materials and dissipate solvent odors. Provide ventilation in poorly ventilated areas to achieve a minimum total fresh air exchange rate of 4 times per hour until the material is substantially dry

E. Maintain non-toxic, unpolluted working area. Provide temporary enclosure to prevent spray from contaminating air.

1.9 GUARANTEE

A. Submit a guarantee, executed by the Contractor and co-signed by the installer, agreeing to repair/replace fireproofing work performed under this Contract which has cracked, flaked, dusted excessively, peeled, or has fallen from the substrate due to defective workmanship for a period of two (2) years from the date of acceptance of the building.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer of the fireproofing material is required to have the material for the required fire ratings of all assemblies and individual members used on this project listed and labeled by UL, or have MEA, BSA, or OTCR approval.

1. Carboline Company, 350 Hanley Industrial Court St. Louis, MO 63144-1599

2. Isolatek International, Furnace St, Stanhope, NJ 07874

3. Sherwin Williams

2.2 MATERIALS

A. Exterior/exposed to the elements and cavity wall application: Solvent-based/epoxy-based/water-based with appropriate top-coat, factory mixed, asbestos free, intumescent material blended for uniform texture capable of being exposed to the elements; conforming to the following requirements:

1. Bond Strength: ASTM D4541; shall have a minimum bond strength of 200 psi (1.0 MPa).

2. Impact Resistance: ASTM D2794; shall have a minimum resistance of 65 in-lbs @ 65 mil DFT.

3. Durometer Hardness: Material when tested in accordance with ASTM D2240 shall have a minimum Shore D of 50.

4. Surface Burning Characteristics, ASTM E84:

a. Flame Spread: < 25 Class A

b. Smoke Developed: < 50 Class A.

5. Abrasion Resistance (either with material or provided by manufacturer's recommended top coat): A maximum of 0.25 grams @ 1,000 cycles when tested in accordance to ASTM D4060.

6. Materials

a. Nullifire S605 by Carboline
b. Sprayfilm WB-4 coated with Sprayfilm-Topseal by Cafco
c. Thermo-lag 3000 by Carboline

B. Interior application: Water-based, factory mixed, asbestos free, intumescent material blended for uniform texture capable of being exposed to the elements; conforming to the following requirements.

1. Bond Strength: ASTM D4541; shall have a minimum bond strength of 120 psi (1.0 MPa).

2. Impact Resistance: ASTM D2794; shall have a minimum resistance of 80 in-lbs @ 65 mil DFT.

3. Durometer Hardness: Material when tested in accordance with ASTM D2240 shall have a minimum Shore D of 50.

4. Surface Burning Characteristics, ASTM E84:

   a. Flame Spread: < 25 Class A

   b. Smoke Developed: < 50 Class A.

5. Abrasion Resistance: A maximum of 0.30 grams @ 1,000 cycles when tested in accordance to ASTM D4060.

6. Materials

   a. A/D Fire Film III by Carboline
   b. Sprayfilm WB 3 and WB 5 by Cafco
   c. Firetex5120 by Sherwin Williams

C. Primer: Primer shall be of types compatible with fireproofing and provide corrosion resistance as per materials in Section 05120.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work. Do not begin application of fireproofing until the substrate is acceptable to receive the fireproofing material. Confirm that the substrate temperature is acceptable. Notify the RIOC and Contractor in writing of any conditions that will prevent the proper completion of the Work.

B. Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.

C. Verify ducts, piping, equipment, or other items which would interfere with application of fireproofing are not positioned until fireproofing work is complete.

D. Verify that voids and cracks in substrate are filled, and projections are removed where fireproofing is exposed to view as a finish material.

E. Beginning of installation means applicator accepts existing substrate.

3.2 PREPARATION

A. Protection

1. Provide ventilation in area to receive sprayed fireproofing, introducing fresh air and exhausting air continuously during, and 24 hours after, application to promote the evaporation of water and optimum drying of applied material. Material must be substantially dry within 30 days of application.

2. Provide temporary enclosures to contain overspray.

3. Protect adjacent surfaces and equipment from damage by overspray. Protect concrete and masonry surfaces exposed to view from overspray by using masks, drop cloths, or other satisfactory coverings.

4. Close off and seal ductwork in areas where fireproofing is being applied.

5. Provide fire extinguisher and post caution signs warning against smoking and open flame when working with flammable materials.

6. Prevent entry by non-fireproofing personnel into spraying and mixing areas or other areas exposed to the wet material. Post signs such as "Slippery When Wet".

B. Surface Preparation

1. Prime steel after proper surface preparation with primer paint, which is dependant on location of members as specified in Section 05120. Exterior steel and those exposed to the cavity are to be zinc metallized prior to priming.

2. Clean substrate of dirt, dust, grease, oil, loose material, or other matter that may effect bond of fireproofing.

3. Seal all penetrations or open ended fireproofing termination by chamfering at a 45 degree angle and sealing with high heat silicone sealant.

4. Install reinforcement over structural members as indicated on Drawings, or U.L. Fire Resistance Directory Listings.

3.3 APPLICATION

A. Location of Each Type of Intumescent Fireproofing

1. Solvent based material - Exterior/exposed to the elements and cavity wall application. Contractor may also use for interior applications where water-based material is called for if finish color selected by Architect of Record is available.

2. Water-based material – interior application

B. Apply primer for fireproofing in accordance with manufacturer's instructions. Do not apply to surfaces which would prohibit proper adhesion.

C. Apply primer according to primer manufacturer's recommendations. Provide primer "cut-back" three inches for bolted connections and 12 inches for welded connections.

D. Apply fireproofing in sufficient thickness to achieve rating, with as many passes necessary to cover with monolithic blanket of uniform hardness, density and texture. Spray and/or roll the finished surface so after final paint the member will have a smooth finish appearance.

E. Patch and repair sprayed fireproofing surfaces damaged by other trades. Payment for such is the responsibility of the trades responsible for such damage.

F. Correct unacceptable work as determined by the Special Inspector and the RIOC and pay for further testing required to prove acceptability of installation.

G. Patch areas from which testing samples have been removed to satisfy fire-rating testing requirements.

H. Finish painting is specified in Section 09900.

3.4 FIELD QUALITY CONTROL

A. Tests

1. The RIOC's testing laboratory will verify the thickness of in-place material in accordance with the AWCI Technical Manual 12-B "Standard Practice for the Testing and Inspection of Field Applied Thin-Film Intumescent Fire-Resistive Materials; an Annotated Guide", latest edition, in accordance with Section BC 1704.12 of the 2014 NYC Building Code.

2. Inspections and tests to be done by the testing laboratory as work progresses are as follows.

a. Visual inspection of substrate prior to application of fireproofing to verify surface preparation. Visual inspection of material installed to check if material is properly applied or is actually overspray.

b. Thickness of intumescent fireproofing applied to structural elements and decks will be in accordance with the AWCI Technical Manual 12-B. Test locations will be selected at random and must be performed prior to top coat application.

c. Visual inspection of completed work including patches to cracking and spalling. The visual acceptance of the intumescent fireproofing by the Special Inspector does not supersede deficiencies in finish appearance determined by the Architect of Record.

B. Inspection

1. Testing Laboratory

a. The RIOC will engage an approved Testing Laboratory or Special Inspection Agency to inspect and perform the above tests.

b. The Testing Laboratory will be responsible to and under the supervision of Special Inspector.

2. Special Inspector

The RIOC will assign, under the requirements of Section BC 1704.12, a Special Inspector to supervise the testing of intumescent fire-resistant coating. The Special Inspector will ensure all required testing is done and that application and substrate temperatures are per the specifications and manufacturer’s instructions, which ever is more stringent.

3. Test Results: Results of above tests will be made available to all parties on a regular basis.

4. When test results indicate fireproofing does not comply with the Contract requirements, additional random testing will be done within the testing area to determine the extent of noncompliance. This additional testing shall be paid for by the Contractor.

C. Nonconforming Fireproofing

1. If fireproofing is less than the required thickness, place additional material in accordance with the manufacturer's recommendations.

2. Areas of improper finish are to be removed or additional material added to provide the finished appearance acceptable to the Architect of Record.

3. Areas of repair or replacement will be retested for compliance with the Specifications.

3.5 CLEANING

A. After completion of fireproofing work clean other surfaces not to be sprayed of any applied fireproofing material.

3.6 PROTECTION

A. Protect applied fireproofing until permanent covering is installed or, where exposed, until final acceptance.

END OF SECTION 072600

* * *

SECTION 072700 - FIRESTOPPING/SMOKE SEALS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide firestopping at all penetrations and juncture joints of fire-rated walls, floors and ceilings in accordance with the requirements of the NYC Building Code.

B. Firestopping and Smoke Seals shall be provided, but not limited to the following specific locations:

1. Penetrations for the passage of duct, cable, cable tray, conduit, piping and electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor slabs and floor/ceiling assemblies), and vertical service shafts.

2. Openings between floor slabs and curtain walls and fire rated walls and curtain walls.

3. Openings between structurally separate sections of walls or floors.

4. Construction Joints between the top of walls and floor or roof slab and steel deck assemblies, or, concrete floor or roof slab.

5. Vertical service shafts at each floor level.

6. Expansion joints in walls and floors.

7. Openings and penetrations in fire-rated partitions or walls containing fire doors.

8. Locations shown specifically on the Drawings.

1.2 REFERENCES

A. References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

1. American Society for Testing and Materials (ASTM)

2. Underwriters Laboratories, Inc. (UL)

3. National Fire Protection Association (NFPA)

4. Warnock Hersey

1. 3 DEFINITIONS

A. Penetration: Any opening or foreign material passing through or into a fire-rated barrier.

B. Fire-Rated: Have the ability to withstand the effects of a standard fire exposure for a specified time period, as determined by qualified testing.

C. Fire-Rated Barrier: A floor, wall, partition or floor-ceiling assembly able to withstand a standard fire and hose stream test without failure.

D. Fire resistance rating: The ability of a structure to act as a barrier to the spread of fire and to confine it to the area of origin. Ratings are expressed in hours and apply to beams, columns, floors, ceilings, roofs, walls and partitions.

E. Firestopping: A means of sealing openings in fire-rated barriers to preserve or restore the fire resistance rating.

F. Firestop System: A material, or combination of materials, installed to retain the integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke or gases through penetrations in fire-rated barriers.

G. F Rating: The time period that the through-penetration firestop system limits the spread of fire through the penetration when tested in accordance with ASTM E814.

H. T Rating: The time period that the penetration firestop system, including the penetrating item, limits the maximum temperature rise to 325°F (163°C) above its initial temperature through the penetration on the non-fire side when tested in accordance with ASTM E814.

1.4 DESIGN REQUIREMENTS

A. Technical Requirements

1. Firestopping materials shall be UL Classified as "Fill, Void or Cavity Material" for use in Through-Penetration Firestop Systems.

2. Firestop Systems shall provide a fire resistance rating at least equal to the hourly resistance rating of the fire-rated barrier and resist passage of smoke and other gases.

B. General Considerations

1. Firestop Systems do not re-establish the structural integrity of load bearing partitions. The Contractor shall consult the RIOC's Representative prior to penetrating any load bearing assembly.

2. Firestop systems are not intended to support live loads or traffic. Contractor shall consult the RIOC's Representative if there is reason to believe these limitations may be violated.

1.5 SUBMITTALS

A. Product Data

Submit manufacturer's product information for each type of firestopping/smoke seal and assembly installed, including application instructions and specifications.

B. Shop Drawing

Submit shop drawings of each firestopping or smoke seal system/assembly to be installed in the project, showing all parts of the system, required clearances.

C. Quality Control Submittals

1. Certificates

a. Furnish manufacturer's certification that materials meet or exceed specification requirements for each of the performance tests specified in Part 2. Provide testing certification.
b. Furnish applicator's certification that material has been completed as specified to meet fire resistance ratings, thickness requirements, and application requirements of the applicable assembly.
c. Furnish UL, BSA, MEA, or OTCR approval of material.
d. Furnish certificate stating each material is 100% asbestos free.

2. Contractor Qualifications

Provide proof of Manufacturer and Applicator qualifications specified under “Quality Assurance”.

D. Mock-up

Provide mock-up as indicated under Quality Assurance.

E. Guarantee

1. Contractor and installer's installation guarantee.

1.6 QUALITY ASSURANCE

A. Qualifications

1. Manufacturer: Company specializing in the manufacture of firestopping/smoke seal materials to be used in this Contract shall have a minimum of five years experience.

2. Installer: All firestopping Work shall be performed by a Subcontractor who will be acceptable to the firestopping manufacturer in the application of its products and systems and have a minimum of three years experience and shall have worked on at least two projects with similar quantities of materials used. .

B. Regulatory Requirements

1. Building Code: Material and application shall meet the requirements for firestopping materials in accordance with the NYC Building Code.

2. Material must have UL or NYC BSA, MEA or OTCR approval for each assembly utilized. Comply with the following for firestopping that is required to be in compliance with BC 713 of the 2014 NYC Building Code:

a. ASTM E84 - Surface Burning Characteristics of Building Materials.
b. ASTM E814 - Fire Tests of Through Penetration Firestops.
c. UL 1479 - Fire Tests of Through-penetration Firestops.
d. UL - Fire Resistance Directory; Through-Penetration Firestop Systems (XHEZ), and Fill, Void or Cavity Materials (XHHW).
e. UL 723 - Standard Test Method for Surface Burning Characteristics of Building Materials.

C. Manufacturer's Certification

1. Manufacturer shall provide written certification stipulating that its products and systems used in this Project, if installed in accordance with the manufacturer's recommendations, shall provide the firestopping specified in this Section, as indicated by its UL rating for that specific installation.

2. The certification shall not include either or both of the following statements, or variations thereof:

"Owner or User shall determine suitability of the product or system for its intended use and assume all risks and liabilities connected therewith".

and,

"Owner or User shall test application of product or system for its specific use".

D. Mock-up

Install, on representative substrates (on site), one mock-up of each type of firestopping system to be used on Project, for each fire rating required and for each type of wall, floor, and ceiling. Acceptable mock-up installations may remain as part of the completed work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, unopened packages bearing name of manufacturer, product identification, and the proper UL labels for fire hazard and fire-resistance classification.

B. Reject damaged packages found unsuitable for use and remove from job site.

C. Store materials off ground, under cover, and away from damp surfaces.

D. Keep materials dry at all times. Wet material shall be discarded.

E. Rotate stock material and use prior to expiration date.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Maintain air and substrate temperature at a minimum temperature of 50°F for 24 hours before, during, and for 24 hours after application of the material or as required by the product literature, which ever is more stringent. Contractor shall provide enclosures with heat to maintain temperatures.

1.9 GUARANTEE

A. Submit a guarantee, executed by the Contractor and co-signed by the installer, agreeing to repair/replace firestopping work performed under this Contract which has cracked, flaked, dusted excessively, peeled, or has separated or fallen from the substrate due to defective workmanship for a period of two (2) years from the date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Hilti Construction Chemicals, Inc., Tulsa, OK.

B. The Carborundum Company, Niagara Falls, NY.

C. 3M Fire Protection Products, St. Paul, MN.

D. Tremco Commercial Sealants & Waterproofing, Beachwood, Ohio

E. Specified Technologies, Inc., Somerville, NJ

F. W. R. Grace & Co., Macungie, PA

G. RectorSeal Corp., Houston, TX

2.2 MATERIALS

A. Grout and sealant systems, as well as integral firestopping sleeves and membranes, shall meet or exceed requirements as specified in Part 1 of this Section and shall be acceptable to the RIOC.

B. Listing of manufacturer does not mean that manufacturer has firestopping assemblies for all conditions to be encountered in the Work. Contractor is responsible for selection of material and system appropriate to the condition.

C. Through-penetration firestop systems shall meet the requirements of ASTM E814 or UL 1479, which include, but are not limited to, the following:

1. Prevent flame pass-through.

2. Restrict temperature to not exceed 325°F over ambient on side of assembly opposite flames.

3. Provide a positive smoke seal.

4. Withstand hose stream test with a minimum positive pressure differential of 0.01 inch (2.49 pa.)

5. Provide an F rating of not less than the required fire rating of the wall penetrated.

6. Provide an F rating and a T rating for floor penetrations of not less than 1 hour but not less than the required fire rating of the floor penetrated, except as follows:

a. Floor penetrations contained and located within the cavity of a wall do not require a T-rating.

b. Metallic piping or tubing penetrating a single fire rated floor, having a maximum 6” diameter can be firestopped with concrete,

grout or mortar of thickness to maintain the fire rating of the floor penetrated. No limit to the number of floors penetrated if the area of the aggregate area of penetration does not exceed 144 square inches in any 100 square feet of floor area.

D. Firestopping materials shall be asbestos-free, emit no toxic or combustible fumes and be capable of maintaining an effective barrier against flame, smoke, gas, and water in compliance with requirements of this Section.

E. Firestopping materials/systems shall be flexible to allow for normal movement of building structure and penetrating items(s) without affecting the adhesion or integrity of the system.

F. Firestopping materials shall not require hazardous waste disposal of used containers/packages.

G. On insulated pipe, the fire-rating classification must not require the removal of the insulation.

H. Firestopping materials shall be free of solvents. Shrinkage while curing shall not exceed shrinkage experienced during specified testing. Firestopping shall remain in complete contact with adjacent construction when fully cured.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine and confirm the compatibility of surfaces to receive firestopping materials. Verify that surfaces are sound, clean and dry and are ready to receive the firestopping.

B. Verify that penetration elements are properly located and securely fixed, with the proper space between the penetration element and surfaces of the opening.

3.2 PREPARATION

A. Protect adjacent surfaces and equipment from damage.

B. Clean surfaces of opening.

3.3 INSTALLATION

A. Install firestopping system in strict accordance with the manufacturer's instructions to obtain/maintain the fire-rating required at the specific location. The Contractor and the RIOC shall be immediately notified of conditions that will

not allow the proper installation of the material to achieve the required rating, such as the annular space between the penetration and sleeve not being wide enough to meet the requirements of the assembly.

B. Provide escutcheons for piping at each side of penetration when subject to view and/or if required by the UL assembly.

3.4 FIELD QUALITY CONTROL

A. Special Inspection

1. The RIOC will assign under the requirements of Section BC 1704.27 a Special Inspector who will inspect the firestopping/smoke seal installation to meet both the Special and Progress Inspection requirements of the 2014 NYC Building Code.

2. The Special Inspector will make inspections and any testing deemed necessary.

3. Special/Progress inspections will be performed in accordance with both paragraphs 10.9.1 (witnessing) and 10.9.2 (destructive verification) of ASTM E2174. The inspector will witness and verify firestopping and smoke sealing installations. The installation process of a minimum of 10% of all firestopping/smoke seals shall be witnessed and 2% of all firestop/smoke seal installations will be verified utilizing destructive means.

B. Nonconforming Firestopping/Smoke Seal Installation

1. When inspection indicates firestopping does not comply with the required assembly, remove and replace firestopping. Failures will result in additional areas of destructive testing.

2. Areas of repair or replacement will be reinspected for compliance to the approved assembly. The costs for additional inspections and testing as required by the inspector shall be borne by the Contractor.

C. Contractors Responsibility for Quality Control

1. Inspect all installations to ensure that all work meets the requirements specified as the Work progresses.

2. Cooperate with the Special Inspector performing Special and Progress Inspections. Provide all access, including scaffolding and ladders. Provide a minimum of 72 hours notice prior to each day of firestopping installation to ensure Inspector is available to witness or verify the requisite number of installations.

3. The Contractor shall include all cost of complying with inspections performed in accordance with ASTM E2174.

4. Do not cover firestopping work until it is accepted and approved by the Special Inspector.

5. The Contractor shall include repair of all firestopping and smoke sealing damaged as a result of the ASTM E2174 destructive verification requirements.

6. The Contractor shall replace all firestopping/ smoke sealing of a certain type if 10% of the witnessed or verified types are determined to be non-compliant. This replacement shall be at no cost to the RIOC.

3.5 CLEANING

A. Remove excess materials, droppings, and debris; remove excess materials from adjacent surfaces.

3.6 PROTECTION

A. Protect firestopping installations from damage until completion of all Project Work.

END OF SECTION 072700

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SECTION 074213 - COMPOSITE METAL WALL & CEILING PANELS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Composite Metal panels.
   1. Applications of composite metal panels include:
      a. Exterior installation of composite metal panels.
      b. Interior installation of composite metal panels.
      c. Exterior column closures
      d. Exterior metal ceiling panels

B. Related Sections: Section(s) related to this section include:
   1. Section 051700 Support System for Suspended Ceilings
   2. Section 055000 Metal Fabrications
   3. Section 076000 Flashing and Sheet Metal
   4. Section 079200 Joint Sealers

1.2 REFERENCES

A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to the extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.

B. ASTM International (ASTM):
   1. ASTM D1781 Standard Test Method for Climbing Drum Peel for Adhesives.
   2. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
   3. ASTM E108 (Modified) Standard Test Methods for Fire Tests of Roof Coverings.
   4. ASTM E283 Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen.
   5. ASTM E330 Standard Test Method for Structural Performance of Exterior

Windows, Curtain Walls and Doors By Uniform Static Air Pressure Difference.

6. ASTM E331 Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors By Uniform Static Air Pressure Difference.

C. American Architectural Manufacturers Association (AAMA):

1. AAMA 2605 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

D. Underwriters Laboratories Inc. (UL):

1. UL 94 Standard for Flammability of Plastic Materials for Parts in Devices and Appliances.

E. International Organization for Standardization (ISO):

1. ISO 9001-2000 Quality Management Systems - Requirements.

1.3 SYSTEM DESCRIPTION

A. Performance Requirements: Provide composite metal panels which have been manufactured, fabricated and installed to withstand loads from deflection and thermal movement and to maintain performance criteria stated by manufacturer without defects, damage or failure.

B. Deflection and Thermal Movement: Provide systems that have been tested and certified to conform to the following criteria under wind loading of 40 psf inward and 40 psf outward:

1. Normal Deflection: Deflection of perimeter framing member not to exceed L/175 normal to plane of the wall; deflection of individual panels not to exceed L/60.

2. Anchor Deflection: At connection points of framing members to anchors, anchor deflection in any direction not to exceed 1/16 inch (1.6 mm).

3. Thermal Movements: Allow for free horizontal and vertical thermal movement, due to expansion and contraction of components over a temperature range from [Specify temperature range] (0– 180 degrees F).

a. Buckling, opening of joints, undue stress on fasteners, failure of sealants, or any other detrimental effects of thermal movement will not be permitted.

b. Fabrication, assembly and erection procedures shall take into account the ambient temperature range at the time of the respective operation.

C. Water and Air Leakage: Provide systems that have been tested and certified to conform to the following criteria:

1. Air Leakage (ASTM E283): Not more than 0.06 (cfm)/sf of wall area (0.003 (L/s) m^2), when tested at 1.57 psf (0.075 kPa).

2. Water Penetration (ASTM E331): No water infiltration under static pressure at a differential of 10% of inward acting design load, 6.24 psf (0.299 kPa) minimum, after 15 minutes.

a. Water penetration is defined as the appearance of uncontrolled water in the wall.

b. Wall design shall feature provisions to drain to the exterior face of the wall any leakage of water at joints and any condensation that may occur within the construction.

D. Structural: Provide systems that have been tested in accordance with ASTM E330 at a design pressure of40 psf and have been certified to be without permanent deformation or failures of structural members.

1.4 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 01 Submittal Procedures Section.

B. Product Data: Submit product data, including manufacturer's SPEC-DATA product sheet, for specified products.

C. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors and textures.

1. Include details showing thickness and dimensions of the various system parts, fastening and anchoring methods, locations of joints and gaskets and location and configuration of joints necessary to accommodate thermal movement.

D. Samples: Submit selection and verification samples for finishes, colors and textures.

1. Selected Samples: Manufacturer's color charts or chips illustrating full range of colors, finishes and patterns available for composite metal panels with factory-applied finishes.

2. Verification Samples:

a. Structural: 12 inch × 12 inch (305 × 305 mm) sample composite panels in thickness specified, from an available stock color, including clips, anchors, supports, fasteners, closures and other panel accessories, for assembly approval. Include panel assembly samples not less than 24 inches × 24 inches (610 × 610 mm), showing 4-way joint.

b. Include separate sets of draw down samples on aluminum substrate, not less than 3 inches × 5 inches (76 × 127 mm), of each color and finish selected, for color approval. Larger samples of standard colors are available with production applied coatings.

E. Quality Assurance Submittals: Submit the following:

1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

2. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and physical requirements.

3. Manufacturer's Instructions: Manufacturer's installation instructions.

4. Manufacturer's Field Reports: Manufacturer's field reports.

F. Closeout Submittals: Submit the following:

1. Warranty: Warranty documents specified herein.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications: Installer experienced in performing work of this section who has specialized in the installation of work similar to that required for this project.
   a. Certificate: When requested, submit certificate indicating qualification.
2. Manufacturer Qualifications: Company with a minimum of 5 years of continuous experience manufacturing panel material of the type specified:
   a. Able to provide specified warranty on finish.
   b. Able to provide a list of 5 other projects of similar size, including approximate date of installation and the name of the Architect for each.
   c. Able to produce the composite material without outsourcing of coating or lamination process.
   d. Able to provide certificate of registration of ISO 9001-2000.
3. Fabricator Qualifications: Company with at least 3 years of experience on similar sized metal panel projects and qualified by the panel material manufacturer. Capable of providing field service representation during construction.

B. Mock-Ups: Install at project site a job mock-up using acceptable products and approved installation methods. Obtain Owner's and Architect's acceptance of finish color (draw down samples to be used for color approval of nonstandard coil coated colors), texture and pattern and workmanship standard. Comply with Division 01 Quality Control, Mock-Up Requirements Section.

1. Mock-up Size: 24"x24" or larger to fit field conditions.
2. Maintenance: Maintain mock–up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
3. Incorporation: Mock-up may be incorporated into final construction upon Owner's approval.

C. Preinstallation Meetings: Conduct preinstallation meeting to verify project requirements, substrate conditions, installation instructions and warranty requirements. Comply with Division 01 Project Management and Coordination, Project Meetings Section.

D. Field Quality Control: Comply with panel system manufacturer's recommendations and guidelines for field forming of panels.

1.6 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 01 Product Requirements Sections.

B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

1. Protection: Protect finish of panels by applying heavy duty removable plastic film during production.

2. Delivery: Package composite wall panels for protection against transportation damage. Provide markings to identify components consistently with drawings.

3. Handling: Exercise care in unloading, storing and installing panels to prevent bending, warping, twisting and surface damage.

D. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

1. Storage: Store panels in well-ventilated space out of direct sunlight.

a. Protect panels from moisture and condensation with tarpaulins or other suitable weathertight covering installed to provide ventilation.

b. Slope panels to ensure positive drainage of any accumulated water.

c. Do not store panels in any enclosed space where ambient temperature can exceed 120 degrees F (49 degrees C).

2. Damage: Avoid contact with any other materials that might cause staining, denting or other surface damage.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

1.8 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and not a limitation of, other rights Owner may have under the Contract Documents.

1. Warranty Period:

a. Panel Integrity: 10 years commencing on Date of Substantial Completion.

b. Finish: [Specify number of years] commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.1 COMPOSITE METAL PANELS

A. Basis-of Design Product Manufacturer: Mitsubishi Plastics Composites America, Inc.

1. Contact: 401 Volvo Parkway, Chesapeake, VA 23320; Telephone (800) 422-7270; Fax: (757) 436-1896; E-mail: info@alpolic.com; website: www.alpolic-northamerica.com.
2. Or approved equal

B. Proprietary Product: ALPOLIC Composite Metal Panels.

1. Standard ALPOLIC composite metal panels.
2. Reflective ALPOLIC composite metal panels

2.2 PRODUCT SUBSTITUTIONS

A. Substitutions: No substitutions permitted without approval by A/R.

2.3 ALTERNATES

A. Contract Provisions and Division 01 Requirements.

2.4 COMPOSITE METAL PANEL MATERIALS

A. Composite Metal Panels:

1. Core: Thermoplastic material that meets performance characteristics specified when fabricated into composite assembly.
2. Face Sheets: Aluminum alloy 3105 H14, 0.020 inch (0.51 mm) thick and as follows: [Choose coil or spray as applicable to quantity].
   a. Coil coated with a fluoropolymer paint finish that meets or exceeds values expressed in AAMA 2605 where relevant to coil coatings.
   b. Thermally bonded in a continuous process, under tension, to the core material.
3. Bond Integrity: Tested for resistance to delamination as follows:
   a. Peel Strength (ASTM D1781): 22.5 in-lb/in (100 N-m/m) minimum.

b. No degradation in bond performance after 8 hours of submersion in boiling water and after 21 days of immersion in water at 70 degrees F (21 degrees C).

4. Fire Performance:
   a. Flamespread (ASTM E84): 25 maximum (4 and 6 mm).
   b. Smoke Developed (ASTM E84): 450 maximum (4 and 6 mm).
   c. Surface Flammability (Modified ASTM E108): Pass (4 and 6 mm).
   d. V-O Rating (4 mm): Comply with UL 94.
5. Product Transparency:
   a. Provide a Product Transparency Declaration (PTD)for the Composite metal panels

B. Production Tolerances:
1. Width: +/- 2 mm.
2. Length: +/- 4 mm.
3. Thickness (4 mm Panel): +/- 0.008 inch (0.2 mm).
4. Thickness (6 mm Panel): +/- 0.012 inch (0.3 mm).
5. Bow: Maximum 0.5% length or width.
6. Squareness: Maximum 0.2 inch (5 mm).
7. Edges of sheets shall be square and trimmed.

C. Panel Thickness: 4 mm (Standard) and 2 mm (Reflective panels).

2.5 ACCESSORIES

A. General: Provide fabricator's standard accessories, including fasteners, clips, anchorage devices and attachments.

2.6 RELATED MATERIALS

A. General: Refer to other related sections for related materials, including cold-formed metal framing, flashing and trim, joint sealers, aluminum windows, glass and glazing and curtain walls.

2.7 FABRICATION

A. General: Shop fabricate to sizes and joint configurations indicated on the drawings.
1. Where final dimensions cannot be established by field measurements, provide

allowance for field adjustment as recommended by the fabricator.

2. Form panel lines, breaks and angles to be sharp and true, with surfaces that are free from warp or buckle.
3. Fabricate with sharply cut edges, with no displacement of aluminum sheet or protrusion of core.

2.8 FINISHES

A. Factory Finish: A fluoropolymer paint finish that meets or exceeds values expressed in AAMA 2605 where relevant to coil coatings.

2.9 SOURCE QUALITY

A. Source Quality: Obtain composite panel products from a single manufacturer.

3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions.

3.2 EXAMINATION

A. Site Verification of Conditions: Verify that substrate conditions are acceptable for product installation.

3.3 PREPARATION

A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.

3.4 INSTALLATION

A. General:
   1. Install panels plumb, level and true, in compliance with fabricator's

recommendations.

2. Anchor panels securely in place, in accordance with fabricator's approved shop drawings.
3. Comply with fabricator's instructions for installation of concealed fasteners and with provisions of Section 07 90 00 for installation of joint sealers.
4. Installation Tolerances: Maximum deviation from horizontal and vertical alignment of installed panels: 0.25 inch (6.4 mm) in 20 feet (6.1 m), non-cumulative.

3.5 FIELD QUALITY REQUIREMENTS

A. Fabricator's Field Services: Upon Owner's request, provide fabricator's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with fabricator's instructions.

3.6 ADJUSTING

A. Adjusting:
   1. Repair panels with minor damage such that repairs are not discernible at a distance of 10 feet (3.1 m).
   2. Remove and replace panels damaged beyond repair.
   3. Remove protective film immediately after installation of joint sealers and immediately prior to completion of composite metal panel work.
   4. Remove from project site damaged panels, protective film and other debris attributable to work of this section.

3.7 CLEANING

A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project site and legally dispose of debris.

3.8 PROTECTION

A. Protection: Protect installed product's finish surfaces from damage during construction.
   1. Institute protective measures as required to ensure that installed panels will not be damaged by work of other trades.

END OF SECTION

075010 CONCRETE DECK WATERPROOFING LIQUID APPLIED SYSTEM

PART 1 - GENERAL

1.01 SYSTEM DESCRIPTION

A. The following specification outlines the requirements for a fully reinforced, quick curing, cold fluid-applied, (PMMA) polymethyl methacrylate liquid resin waterproofing membrane with approved broadcast mineral aggregate surfacing or approved coating and all other ancillary waterproofing work including but not limited to, installation of drains, pipe flashings, penetration flashings, sealants and metal work as specified.

1. All membrane materials shall have a superior coefficient of expansion, to allow for differential movement between the horizontal and vertical surface of the flashed penetration or projection.

2. New membrane system MUST provide fast-drying primers to allow substrate preparation, priming and membrane application to be completed the same day.

3. The use of cold fluid-applied reinforced (PMMA) polymethyl methacrylate membrane materials will be required for all field membrane and flashings.

4. Any occupied and/or heated spaces MUST be waterproofed using a fully reinforced system.

1.02 SECTION INCLUDES

A. Adhered cold fluid-applied reinforced (PMMA) polymethyl methacrylate waterproofing system including, membrane, penetration flashings, base flashings, and expansion joints.

B. Complete removal of all existing overburden materials and roofing/waterproofing membrane.

C. Substrate preparation, cleaning, leveling and patching

D. Temporary waterproofing

E. Waterproofing membrane installation

F. Flashing installation and expansion joint installation

G. Traffic-bearing surfacing installation

1.03 RELATED SECTIONS

A. Supplementary General Conditions

B. Basic Requirements

C. Wood Blocking and Nailers

D. Sheet Metal Flashing and Trim

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM) C 836 Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane.

B. National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual.

C. ACI-308 - Recommended Practice for Curing Concrete

D. ASTM - D638 - Test Methods for Tensile Properties of Plastics

E. ASTM - D4258 - Standard Practice for Surface Cleaning Concrete for Coatings

F. ASTM - D4259 - Standard Practice for Abrading Concrete

G. ASTM - D4541 - Method for Pull-Off Strength of Coatings using Portable Adhesion Tester

H. ASTM - E96(A) - Test Methods of Moisture Transmission of Material

I. ASTM E-108, ANSI/UL 790 for fire resistance.

J. Steel Structures Painting Council (SSPC)

1.05 SUBMITTALS FOR REVIEW

A. Membrane System Product Data: Provide current standard printed product literature indicating characteristics of membrane materials, flashing materials, components, and accessories product specification and installation.

B. Product Samples: Submit product samples of membrane and flashing materials showing color, texture, thickness and surfacing representative of the proposed system for review and approval by the Owner's Representative.

C. Submit sample copies of both the Manufacturer and Applicator warranties for the periods stipulated. Each specimen must be a preprinted representative sample of the issuing company's standard warranty for the system specified.

D. Submit copies of current Material Safety Data Sheets (MSDS) for all components of the work.

E. Membrane Shop Drawings: Submit shop drawings of cold fluid-applied reinforced polymethyl methacrylate membrane showing all a project plan, size, flashing details, and attachment for review and approval by the Owner's Representative and Membrane Manufacturer.

1.06 QUALITY ASSURANCE

A. Membrane Manufacturer: Company specializing in manufacturing the products specified in this section with ten (10) years documented experience. Membrane Manufacturer shall submit the following certifications for review:

1. Substrates and conditions are acceptable for purpose of providing specified warranty.
2. Materials supplied shall meet the specified requirements.

B. Applicator: Company specializing in performing the work of this section with (3) years documented experience and approved by system manufacturer for warranted membrane installation. Applicator shall submit the following certification for review:

1. Applicator shall submit documentation from the membrane manufacturer to verify contractor's status as an approved applicator for warranted installations.

C. Evaluate moisture content of substrate materials. Constructor shall determine substrate moisture content throughout the work and record with Daily Inspection Reports or other form of reporting acceptable to the Owner or designated Representative, and Membrane Manufacturer.

D. Random tests to determine tensile bond strength of membrane to substrate shall be conducted by the Contractor at the job site using an Elcometer Adhesion Tester Model 106 or similar device. Contractor shall perform tests at the beginning of the Work, and at intervals as required to assure specified adhesion with a minimum of three (3) tests per 5000 square feet. Smaller areas shall receive a minimum of three (3) tests. Test results shall be submitted to the Owner or his designated Representative and the Membrane Manufacturer. Contractor shall immediately notify the Owner or his designated Representative and Membrane Manufacturer in the event tensile bond test results are below specified values.

1. Adequate surface preparation will be indicated by tensile bond strength of membrane to substrate greater than or equal to 220 psi (1.5 N/mm^2) for pedestrian traffic and 300 psi (2.0 n/mm^2) for vehicular (low speed) traffic and water flow/containment.
2. In the event the tensile bond strengths are lower than the minimum specified, additional substrate preparation is required. Repeat testing to verify suitability of substrate preparation.

E. Monitor quantities of installed materials. Monitor application of resin mixture, reinforcing fleece and flashing. Perform Work in accordance with manufacturer's instructions.

F. Mock-up areas shall be used to determine required methods and tools to obtain degree of substrate preparation required by the membrane manufacturer. Conduct tests as required to verify that substrate preparation meets specified requirements. Tests shall include, but are not limited to, tensile bond strength and moisture content of substrate.

1. Prepare and clean a three (3) foot (0.9 m) by three (3) foot (0.9 m) area of each substrate material type.

2. Submit findings in writing to Owner or his designated Representative and Membrane Manufacturer.
3. Mock-up areas shall be maintained for quality control for the entire project.

1.07 REGULATORY REQUIREMENTS

A. Conform to applicable building and jurisdictional codes for roofing/waterproofing assembly and fire resistance requirements.

B. Comply with requirements of OSHA, NIOSH or local governing authority for work place safety.

C. Comply with authority or agency “Confined Space Policy” during and throughout all work to be performed.

1.08 PRE-INSTALLATION MEETING

A. Convene a pre-installation meeting at the job site (1) week before starting work of this section. Require attendance of parties directly affecting work of this section, including but not limited to, Architect, and Owner's Representative, Roofing/Waterproofing Contractor, and Membrane Manufacturer's Representative. Review roofing/waterproofing preparation and installation procedures, coordination and scheduling required with related work, and condition and structural loading limitations of deck/substrate.

1.09 DELIVERY, STORAGE, AND PROTECTION

A. The Contractor together with the Owner or his designated Representative shall define a storage area for all components. The area shall be cool, dry, out of direct sunlight, and in accordance with manufacturer‘s recommendations and relevant regulatory agencies. Materials shall not be stored in quantities that will exceed design loads, damage substrate materials, hinder installation or drainage.

B. Store solvent-bearing solutions, resins, additives, inhibitors or adhesives in accordance with the MSDS and/or local fire authority. After partial use of materials replace lids promptly and tightly to prevent contamination.

C. Roll goods shall be stored horizontally on platforms sufficiently elevated to prevent contact with water and other contaminants. DO NOT use rolls which are wet, dirty or have damaged ends.

D. Waterproofing materials must be kept dry at all times. If stored outside, raise materials above ground or roof level on pallets and cover with a tarpaulin or other waterproof material. Plastic wrapping installed at the factory should **not** be used as outside storage covers.

E. Follow manufacturer's directions for protection of materials prior to and during installation. Do not use materials which have been damaged to the point that they will not perform as specified. Fleece reinforcing materials must be clean, dry and free

of all contaminants.

F. Copies of all current MSDS for all components shall be kept on site. Provide any and all crewmembers with appropriate safety data information and training as it relates to the specific chemical compound he or she may be expected to deal with. Each crewmember shall be fully aware of first-aid measures to be undertaken in case of incidents. Comply with requirements of OSHA, NIOSH or local governing authority for work place safety.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not apply roofing/waterproofing membrane during or with the threat of inclement weather.

B. Application of cold fluid-applied reinforced polymethyl methacrylate waterproofing membrane may proceed while air temperature is between 23 °F and 95 °F (-5 - 35 °C) providing the substrate is a minimum of 5 °F above the dew point.

C. Application of cold fluid-applied polymethyl methacrylate waterproofing surfacing/wearing resins may proceed while air temperature is between 32 °F and 95 °F (0 - 35 °C) providing the substrate is a minimum of 5 °F above the dew point.

D. When ambient temperatures are at or expected to fall below 23 °F (-5 °C) or reach 95 °F (35 °C) or higher, follow Membrane System Manufacturer's recommendations for weather related restrictions and application procedures.

E. Ensure that substrate materials are dry and free of contaminants. DO NOT commence with the application unless substrate conditions are suitable. Contractor shall demonstrate that substrate conditions are suitable for the application of the materials.

F. Where required by the Owner or his designated Representative, Contractor shall implement odor control and elimination measures prior to and during the application of the roofing/waterproofing materials. Control/elimination measures shall be field tested at off-hours and typically consists of one (1) or a multiple of the following measures:

1. Sealing of air intakes with activated carbon filters. Install filters in accordance with requirements and recommendations of the filter manufacturer. Seal filters at joints and against building exterior walls to prevent leakage of unfiltered air where required due to size of intake opening. Provide track system to secure filters.
2. Erection and use of moveable enclosure(s) sized to accommodate work area(s) and stationary enclosure for resin mixing station. Enclosure shall be field constructed or pre-manufactured of fire retardant materials in compliance with local code requirements in accordance with requirements of the Owner or his designated Representative. Equipment enclosure(s) with mechanical air intake/ exhaust openings and Odor Control Air Cleaners, as required to clean enclosed air volume and to prevent odor migration outside the enclosure. Exhaust opening shall be sealed with activated carbon filter.

3. Placement of odor elimination stations inside and outside of the enclosure(s) as required by field condition, in coordination with the Owner or his designated Representative.
4. Protection of Contractor personnel and occupants of the structure and surrounding buildings as necessary to comply with requirements of OSHA, NIOSH and/or governing local authority.
5. When disposing of all refuse or unused materials, observe all EPA, OSHA or local disposal requirements.

1.11 COORDINATION & PROTECTION

A. Coordinate the work with the installation of associated metal flashings, accessories, appurtenances, etc. as the work of this section proceeds.

B. Building components shall be protected adequately (with tarp or other suitable material) from soil, stains, or spills at all hoisting points and areas of application. Contractor shall be responsible for preventing damage from any operation under its Contract. Any such damage shall be repaired at Contractor's expense to Owner's satisfaction or be restored to original condition.

C. Provide barricades, retaining ropes, safety elements (active/passive) and any appropriate signage required by OSHA, NIOSH, and NSC and/or the Owner or designated Representative.

D. Protect finished roofing/waterproofing membrane from damage by other trades. Do not allow waste products containing petroleum, grease, acid, solvents, vegetable or mineral oil, animal oil, animal fat, etc. or direct steam venting to come into direct contact with the membrane. Contact membrane manufacturer for further exposure limitation and restrictions.

1.12 WARRANTY

A. Manufacturer's Standard NDL Warranty: Provide Twenty (20) Year manufacturer's warranty under provisions of this section. This warranty provides for cost of labor and materials for loss of watertightness, limited to amounts necessary to effect repairs necessitated by defective material, with no dollar limitation (“NDL”).

B. Waterproofing Contractor's Warranty: Provide Five (5) year "Applicator Maintenance Warranty" covering workmanship for all work of this section including installation of membrane, flashings, metal work, and roofing/waterproofing accessories.

C. Submit (2) executed copies of both the manufacturer and applicator warranties for the periods stipulated, starting from the date of substantial completion. Each warranty must be signed by an authorized representative of the issuing company.

PART 2 - PRODUCTS

2.01 GENERAL

A. The products herein specified are totally pre-engineered products of the listed manufacturer and establish criteria for the approval of substitutions. Products must be part of a pre-engineered system, equivalent in function, quality, composition and method of application to be considered for approval as an "Approved Substitute."

1. Alsan RS System by SOPREMA, Inc., Wadsworth, OH
   Contact: Maciej Tobolewski, cell. # (908) 400-1369

2.02 MANUFACTURERS – MEMBRANE

A. Membrane: Two-component, with catalyst, cold fluid-applied reinforced (PMMA) polymethyl methacrylate waterproofing membrane with a 360 degree needle punched non-woven 110 g/m^2 polyester reinforcing fleece, for a finished dry film membrane thickness of .115 inch nominal per ply; conforming to ASTM C 836. Provide products manufactured and supplied by the following:

1. SOPREMA System's Alsan RS 230 Field resin for use in an adhered waterproofing system.
2. Or approved equal.

B. Physical Properties:

Property	Value	Test Method
Color	Pebble Gray	-
Physical state	(Liquid) Cures to solid	-
Nominal thickness (with Alsan RS Fleece)	115 mils	ASTM D5147 (Sect. 5)
Elongation @ peak load, avg.	55%	ASTM D412 (dumbbell)
Peak load @ 73°F, avg.	809 lbf/in^2 (809 kN/m^2)	ASTM D412 (dumbbell)
Tear strength	107 lbf (0.5 kN)	ASTM D5147 (Sect. 7)
Shore A hardness, avg.	81	ASTM D2240
Water absorption, (Method I) (24h @ 73°F)	0.41%	ASTM D570
Water absorption, (Method I)(48h @ 122°F)	1.57%	ASTM D570
Low temperature flexibility	-13°F (-25°C)	ASTM D5147 (Sect.11)
Dimensional stability (maximum movement)	-0.063%	ASTM D5147 (Sect.10)
Usage time*	15-20 minutes	-
Rainproof after*	30 minutes	-
Solid to walk on after*	60 minutes	-
Solid to drive on with air rubber tires	3 hours	-

after*		
Overburden may be applied after	3 hours	-
Completely hardened after	3 hours	-
Crack spanning	2mm / 0.08 inch	-
Resistance to temperatures up to (short term)	250°C/482°F	-
*All times are approximate and depend upon wind, humidity and temperature.		

2.03 FLASHINGS

A. Membrane Flashings: Two-component, with catalyst, cold fluid-applied reinforced (PMMA) polymethyl methacrylate flashing/vertical grade waterproofing membrane with a 360 degree needle punched non-woven 110 g/m^2 polyester reinforcing fleece, for a finished dry film membrane thickness of .115 inch nominal per ply; conforming to ASTM C 836. Provide products manufactured and supplied by the following:

1. SOPREMA System's Alsan RS 230 Flash resin for use in an adhered waterproofing system or approved equal.

2.04 ACCESSORIES

A. **Polymethyl Methacrylate Primer:** Two-component, high solids polymethyl methacrylate resin for use in improving adhesion of membrane to wood, asphalt and concrete substrate surfaces. Monitor application rate and adjust depending on substrate absorbency. Provide products manufactured and supplied by the following:

1. SOPREMA System's Alsan RS 276 Primer resin for use in an adhered waterproofing system applied over cementitious/masonry and wood substrates.
2. SOPREMA System's Alsan RS 222 Primer resin for use in an adhered waterproofing system applied over asphalt surfaces.

B. **Epoxy Primer (Protection from Substrate Wetness):** Two-component, solvent-free, 100% solids, epoxy resin for use in improving adhesion of membrane to cementitious/masonry substrate surfaces. Monitor application rate and adjust depending on substrate absorbency.

1. SOPREMA System's Alsan VRX Primer for use in an adhered waterproofing system applied over cementitious/masonry and wood substrates.

C. **Reinforcement Fleece:** A 360 degree needle punched non-woven 110 g/m^2 polyester reinforcing fleece used to improve tear strength, puncture resistance, flexural fatigue and crack bridging capabilities while maintaining membrane uniformity. Provide products manufactured and supplied by the following:

1. SOPREMA's Alsan RS Fleece reinforcement fabric for use in an adhered waterproofing system.

D. **Surface Leveling/Pitching Mortar Resin:** Multi component, high solids polymethyl methacrylate mortar resin mix for use in leveling, pitching and smoothing deck substrate surfaces. Provide products manufactured and supplied by the following:

1. SOPREMA System's Alsan RS 233 Self-Leveling Mortar resin for use in an adhered waterproofing system.
2. SOPREMA System's Alsan RS Repair Mortar resin for use in adhered waterproofing system.

E. **Patching, Filling and Smoothing Resin:** Two-component, high solids polymethyl methacrylate paste resin for use in filling surface cracks, voids and depressions and for smoothing/leveling surfaces prior to application of membrane system. Provide products manufactured and supplied by the following:

1. SOPREMA System's Alsan RS Paste resin for use in an adhered waterproofing system.

F. **Tools, Accessories, and Cleaners:** Supplied and/or approved by membrane manufacturer for product installation.

G. **Catalyst/Curing Agent:** White granular powder, based on dibenzoylperoxide, used as a reactive agent to induce curing of all polymethyl methacrylate resins. Provide products manufactured and supplied by the following:

1. SOPREMA's Alsan RS Catalyst Powder for use with all regular-odor polymethyl methacrylate resins.

H. **Leveling and Patching Aggregate:** Silica sand shall be washed, kiln-dried, and dust-free, suitable for troweling or pourable self-leveling, round grain or angular with the following size specification:

1. For voids less than ¼" in depth: 0.4 - 0.8 mm
2. For voids ¼" to 2" in depth: 0.7 - 1.2 mm

Mixing Proportions shall be a ratio of resin to sand at 1:2 by volume or as approved by membrane manufacturer.

I. **Backer Rod:** Expanded, closed-cell polyethylene foam designed for use as filler or with cold-applied joint sealant.

J. **Wood Nailers and Cant Strips:** New wood nailers and cant strips shall be pressure treated for rot resistance (e.g., "Wolmanized" or "Osmose K-33"), #2 or better lumber. Asphaltic or creosote treated lumber is **not** acceptable.

K. **Miscellaneous Fasteners:** Appropriate for purpose intended and approved by membrane system manufacturer; length required for thickness of material as supplied by membrane manufacturer.

L. **Caulking:** Single component, non-sag elastomeric polyurethane sealant, as recommended or supplied by membrane manufacturer for use in making airtight and watertight seals where required.

1. SOPREMA System's Sopramastic sealant.

M. **Drains:** Roof drain, strainer, as approved by membrane manufacturer.

N. **Temporary and Night Sealant:** As recommended or required by membrane manufacturer.

2.05 TRAFIC-BEARING SURFACING AND COATINGS

A. **Wearing/Surfacing Resin:** Multi component, high solids polymethyl methacrylate mortar resin mix for use in leveling of surfaces and in embedment of approved silica quartz aggregate in high traffic vehicular systems. Provide products manufactured and supplied by the following:

1. SOPREMA's Alsan RS 233 Self-Leveling Mortar resin for use in an adhered waterproofing system or approved equal.

B. **Topcoat Surfacing Aggregate:** Kiln-dried surfacing silica quartz and/or ceramic-colored aggregate shall be washed, kiln-dried, and dust-free with the following size specification:

1. Pedestrian Traffic: 0.4 - 0.8 mm
2. Vehicular Traffic : 0.7 - 1.2 mm
3. Bond / Wearing Layer: 1.0 - 1.6 mm

C. **Topcoat Surfacing Chip Flakes:** Flat, approx. 1/16"+ size angular pigmented polymer flakes suitable for broadcast. Chips are used as a textured and decorative broadcast medium with surfacing liquid-applied membrane systems and as a decorative component in aesthetic topcoats. Provide products manufactured and supplied by the following

1. SOPREMA's Alsan RS Deco Chips for use in adhered waterproofing system.

D. **Topcoat/Sealer Resin:** Two-component, high solids polymethyl methacrylate resin for use in sealing the quartz aggregate, embedding chip polymer flakes and aesthetic color topcoat finishes. Provide products manufactured and supplied by the following:

1. SOPREMA's Alsan RS 287 Finish base resin topcoat for use in adhered waterproofing system. Alsan RS Color Pack is required to be mixed with base resin.
2. SOPREMA's Alsan RS 281 Finish translucent top coat for use in adhered waterproofing system.

E. **Ramp and Parking Deck Texturized Topcoat Surfacing Resin:** Two-component, high solids polymethyl methacrylate resin with pre-mixed grain for use in traffic ramp and parking deck garage area applications. Provide products manufactured and supplied by the following:

1. SOPREMA's Alsan RS 289 Textured Finish base resin for use in parking deck areas. Alsan RS Color Pack is required to be mixed with base resin.
2. SOPREMA's Alsan RS Textured Coating resin for use in parking deck ramp areas.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck/substrate openings, curbs, and protrusions through deck/substrate, wood cant strips and reglets are in place and solidly set.

C. Verify deck/substrate is structurally supported, secure and sound.

3.02 PREPARATION OF SUBSTRATE

A. **General:** All existing overburden materials, traffic bearing surfacing, waterproofing membrane, base flashings, edge metal, flanged metal flashings, cants, wood blocking, nonfunctional penetrations/curbs, drain assemblies, metal trim, counterflashing, etc; are to be removed down to the structural deck.

1. The contractor shall determine the condition of the existing structural deck/substrate. All defects in the deck or substrate shall be corrected before new waterproofing work commences. Areas of deteriorated deck/substrate, porous or other affected materials must be removed and replaced with new to match existing.
2. Prepare flashing substrates as required for application of new waterproofing membrane flashings.
3. Inspect substrates, and correct defects before application of new waterproofing. Fill all surface voids greater than 1/8 inch wide with an acceptable fill material.
4. Remove all ponded water, snow, frost and/or ice from the work substrate prior to installing new waterproofing materials.
5. The final substrate for waterproofing shall be clean, dry, free of loose, spalled or weak material including coatings, mineral aggregate, and flood coat/gravel surfacing, oil, grease, contaminants, abrupt changes in level, waterproofing agents, curing compounds, and free of projections which could damage membrane materials.

B. **Concrete:**

1. New concrete shall have cured a minimum of 28 days in accordance with ACI-308.
2. New or existing concrete shall be free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, bituminous products and previous waterproofing materials.
3. New or existing concrete shall be dry with maximum moisture content of six (6) percent. Determinations of moisture content shall be performed by the Contractor. Contractor shall be responsible to perform periodic evaluations of moisture content during the work. Moisture evaluation results shall be

submitted in writing to the Owner or his designated Representative and Waterproofing manufacturer for acceptance.

4. Where the substrate moisture content exceeds acceptable levels, or where moisture migration to the area below the membrane application cannot be positively eliminated, Contractor may utilize an approved thixo agent / quartz mix primer or epoxy primer in lieu of the polymethyl methacrylate primer. The use of thixo agent / quartz mix primer and epoxy shall be contingent on the written approval by Waterproofing Manufacturer's Technical Department.
5. Where required, concrete shall be abrasively cleaned in accordance with ASTM D4259 to provide a sound substrate free from laitance with an open concrete surface. When using mechanical methods to remove existing waterproofing products or surface deterioration, the surface profile is not to exceed ¼ inch (peak to valley).
6. The substrate shall be sound and all spalls, voids and blow holes on vertical or horizontal surfaces must be repaired prior to placement of the primer coat. Spalls and other deterioration shall be repaired in accordance with the requirements of the Owner or his designated Representative and Membrane manufacturer.
7. Areas of minor surface deterioration of 0.50” (13 mm) or greater in depth shall be repaired to prevent possible ponding of the system, leading to excessive usage of primer and resin.
8. Extent and location of thin surface patching shall require approval of the Owner or his designated Representative and Waterproofing Manufacturer prior to the application of any system component.
9. For concrete materials with a compressive strength of less than 3,500 psi contact Waterproofing Manufacturer Technical Department for substrate preparation requirements.

C. **Masonry:**

1. Walls shall be built with hard kiln dried brick or waterproof concrete block construction.
2. Areas of soft or scaling brick or concrete, faulty mortar joints, or walls with broken, damaged or leaking coping shall be repaired in accordance with the requirements of the Owner or his designated Representative and Flashing Membrane Manufacturer.
3. Where the substrate moisture content exceeds acceptable levels, or where moisture migration to the area below the membrane application cannot be positively eliminated, Contractor may utilize an approved thixo agent / quartz mix primer or epoxy primer in lieu of the plain polymethyl methacrylate primer. The use of thixo agent / quartz mix primer and epoxy shall be contingent on the written approval by Waterproofing Manufacturer's Technical Department.

D. **Wood/Plywood:**

1. Plywood shall be identified with American Plywood Association (APA) grade trade marks and shall meet the requirements of product standard PS1. Strip plywood joints with four inch (4") wide strip of waterproofing membrane. Cover knot holes or cracks with strips of waterproofing membrane.

E. **Steel/Metal:**

1. Clean and prepare metal surfaces to near white metal in accordance with SSPC - SP3 (power tool clean) or as required by membrane manufacturer. Extend preparation a minimum of three (3) inches beyond the termination of the membrane flashing materials. Notch steel surfaces to provide a rust-stop.
2. Stainless steel (series 400, 300) shall be abraded to provide a rough open surface.

F. **Other Flashing Surfaces:**

1. Remove all contaminants as required by membrane manufacturer. Surface preparation shall be performed by means approved by Owner or his designated Representative.

G. **Finish Leveling, Patching and Crack Preparation:**

1. General: Resin/sand mix is the preferred material for all substrate finish leveling, crack and wall/deck preparation and patching. Resin/sand patching mix provides a fast-set time of approximately 30 minutes and does not require surface grinding.

2. Primer/sand mix is an alternative substrate leveling and patching material over horizontal surfaces. Primer/sand patching mix provides a set time of approximately 30 minutes, and does not require surface grinding. Primer/sand mix is typically applied in conjunction with general surface priming.

3. Substrate Leveling & Patching: Substrate conditions are to be evaluated by the Contractor, the Owner, or his designated Representative, and Membrane manufacturer. Perform leveling and patching operations as follows:

   a) Level uneven horizontal and low-slope surfaces with a leveling mixture of (PMMA) polymethyl methacrylate Alsan RS 233 Self-Leveling Mortar [depth < ½“, (12mm)] resin. Depths < ½“ should be build up in separate layers. Spread and plane this resin with a squeegee, trowel and/or roller to achieve a flat surface. Spike roller may be used to smooth out the surfaces.

   b) Fill cavities on horizontal and low-slope surfaces with a patching mixture of (PMMA) polymethyl methacrylate primer and approved kiln-dried sand in a 1:3 primer to sand ratio by volume or with (PMMA) polymethyl methacrylate Alsan RS Paste using trowels to apply the resin mortar in place and achieve flat surface.

c) Fill cavities on sloped and vertical surfaces with (PMMA) polymethyl methacrylate Alsan RS Paste using trowels to apply the resin mortar in place and achieve flat surface.

d) Silica sand must be kept absolutely dry during storage and handling.

a) Any surface to be leveled or filled must first be primed with an appropriate (PMMA) polymethyl methacrylate primer and all Alsan RS resin mortars shall be placed in lifts no greater than the maximum thickness indicated by the manufacturer.

4. Joint and Crack Preparation: Joints, cracks and fractures in the structural deck/substrate shall be prepared as defined below prior to installation of the waterproofing membrane. Note: Joints, cracks, and fractures may telegraph through the waterproofing membrane.

a) Non-Moving Cracks: Determine that crack is non-moving. Clean out crack by brushing and oil-free compressed air. Fill crack with (PMMA) polymethyl methacrylate Alsan RS Paste. Allow for a minimum of one (1) hour cure or as required by product manufacturer.

b) Moving Cracks: Determine that crack is moving. Clean out crack by brushing and oil-free compressed air. Fill crack with (PMMA) polymethyl methacrylate Alsan RS Paste. Allow for a minimum of one (1) hour cure or as required by product manufacturer. Apply resin and 4 inch (10 cm) wide strip of membrane (resin and fleece) in strict accordance with Membrane manufacturer's written instructions.

3.03 WOOD NAILER LOCATION AND INSTALLATION

A. Install pressure-treated wood nailers as specified, or as required by the Membrane manufacturer.

B. Secure Wood Nailer: Wood nailers shall be firmly fastened to the deck. The wood nailer attachment must be able to resist a minimum force of 200 lbs. per lineal foot, in any direction. Mechanically fasten wood nailers as required to resist a force of 200 lbs per lineal foot, but with no less than 5 fasteners per 8 foot or 6 fasteners per 10-foot length of nailer. Refer to current FM Loss Prevention Bulletin 1-49 for additional attachment recommendations.

3.04 PRIMER APPLICATION

A. General:

1. Mix and apply two-component primer in strict accordance with written instructions of Membrane Manufacturer. Use only proprietary materials, as

supplied by the membrane manufacturer.

2. The substrate surface must be dry, with any remaining dust or loose particles removed using clean, dry, oil-free compressed air, industrial vacuum, cloth wipe or a combination of methods.
3. Do not install primer on any substrate containing newly applied and/or active asphalt, coal-tar pitch, creosote or penta-based materials unless approved in writing by Membrane Manufacturer. Some substrates may require additional preparation before applying primer.

B. Mixing of Polymethyl Methacrylate Primer:

1. Premix polymethyl methacrylate primer thoroughly with a spiral agitator or stir stick. Add pre-measured catalyst amount into mixed primer container and mix the components for approximately 2 minutes with a clean spiral agitator on slow speed or stir stick without creating any bubbles or streaks. DO NOT AERATE. The primer solution should be a uniform color, with no light or dark streaks present.

2. Do not thin primer. Determine required primer coverage for each substrate material/condition and apply in strict accordance with written instructions of Membrane Manufacturer.

3. Mix only that amount of primer that can be used within 15 minutes.

C. Mixing of Two-Component Epoxy Primer:

1. Mix A and B components together with a spiral agitator or stir stick. Use slow speed. DO NOT AERATE. The primer solution should be a uniform color, with no light or dark streaks present.
2. Do not thin primer. Determine required primer coverage for each substrate material / condition and apply in strict accordance with written instructions of Membrane Manufacturer.
3. Mix only that amount of primer that can be used within 15 minutes.

D. Application of Primer:

1. Apply primer in accordance with manufacturer's written instructions and details.

2. Roll or brush the primer evenly onto the surface to fully saturate the substrate in one application. Do not allow primer to pond or collect in low areas.

3. Apply primer only up to the edge of the membrane flashing terminations. Primer application past the membrane terminations requires surfacing with an approved material.

4. For polymethyl methacrylate primer applications over cementitious substrates where protection from substrate wetness is required, apply primer coat at a heavier application rate until pore saturation is achieved.

5. For epoxy based primer applications, apply kiln-dried sand into the final coat of primer while still wet at the rate of 30 lbs. per 100 square feet (1.5 kg/m²). Use quartz size # 0 (0.4 – 0.8 mm).

6. Allow polymethyl methacrylate primers to cure for a minimum of thirty (30) minutes before membrane application. Allow epoxy-based quick-dry primers to cure for a minimum of two (2) hours before membrane application. Membrane must be applied to primer only when completely dry and without tack.

7. Premature exposure to moisture may require removal and application of new primer. DO NOT apply new primer over exposed primer older than six (6) months, primer prematurely exposed to moisture, or primer used as temporary waterproofing, unless approved in writing by the Membrane Manufacturer.

E. Disposal of Primer:

1. Cured primer may be disposed of in standard landfills. This is accomplished by thoroughly mixing all components.

2. Uncured primer is considered a hazardous material and must be handled as such, in accordance with local, state and federal regulation. Do not through uncured resin away.

3.05 MEMBRANE APPLICATION

A. General:

1. Mix and apply cold fluid-applied reinforced polymethyl methacrylate waterproofing membrane in strict accordance with written instructions of Membrane Manufacturer. Use only proprietary membrane resins and materials, as supplied by the membrane manufacturer.

2. The primed substrate surface shall be dry, with any remaining dust or loose particles removed using clean, dry, oil-free compressed air, industrial vacuum, cloth-wipe or a combination.

3. Protect all areas where membrane has been installed. Do not work off installed membrane during application of remaining work before three (2) hours of curing. Movement of materials and equipment across installed membrane is not acceptable. If movement is necessary, provide complete

protection of affected areas.

4. Closely follow the Membrane Manufacturer's recommendation for hot and cold weather application. Monitor surface and ambient temperatures, including the effects of wind chill.

B. Mixing of Resin:

1. Mix resin with a spiral agitator for a minimum of 2 minutes until the liquid has a uniform color.

2. Add the pre-measured Catalyst Powder to resin and mix with the same agitator for 2 minutes or until the powder is completely mixed. The catalyst is completely dissolved when there are no white specs remaining.

C. Application of Resin/Fleece

1. Apply mixed resin to the prepared surface in accordance with manufacturer's written instructions and details. The resin should be rolled or brushed liberally and evenly onto the surface using a broad, even stroke. Cover one working area at a time, between 15 – 20 ft.^{2} (1.4 – 1.9 m^2).

2. Roll out dry polyester fleece onto the liquid resin mix, making sure the SMOOTH SIDE IS FACING UP (natural unrolling procedure), avoiding any folds and wrinkles. The fleece will begin to rapidly saturate with the liquid resin mix. Use a medium nap roller or brush to work the resin into the fleece, saturating from the bottom up, and eliminating air bubbles, wrinkles, etc. The appearance of the saturated fleece should be light opaque amber with no white spots. White spots are indications of unsaturated fleece or lack of adhesion. It is important to correct these faults before the resin cures.

3. Apply additional liquid resin mix on top of fleece in accordance with manufacturer's written instructions and details to finish the saturation of the fleece. Roll this final coating into the fleece, which will result in a glossy appearance. The fleece can only hold so much resin and all excess should be rolled forward to the unsaturated fleece, eliminating ponding or excessive build-up of the resin. Any excess resin left on the top of the fleece will weather and peel off. The correct amount of resin will leave no whiteness in fleece and there will be a slightly fibrous surface texture. The final resin coating should be smooth and uniform.

4. Prevent contact between mixed/unmixed resin and new/existing membrane. If any unmixed resin contacts membrane surface remove immediately and clean thoroughly with a cloth rag.

5. At all fleece seams, allow a 2" (5 cm) overlap for all side joints and a 4" (10 cm)

overlap for all end joints.

6. At membrane tie-offs, clean in-place membrane with Alsan RS Cleaner once resin has cured. Allow cleaner to fully evaporate before application of new resin.

D. Disposal of Resin:

1. Cured resin may be disposed of in standard landfills. This is accomplished by thoroughly mixing all components.
2. Uncured resin is considered a hazardous material and must be handled as such, in accordance with local, state and federal regulation. Do not throw uncured resin away.

3.06 FLASHING APPLICATION

A. General:

1. Install flashing system in accordance with the requirements/recommendations of the Membrane manufacturer and as depicted on standard drawings and details. Provide system with base flashing, edge flashing, penetration flashing, counter flashing, and all other flashings required for a complete watertight system.
2. Wherever possible, install the flashings before installing the field membrane to minimize foot traffic over newly installed field membrane.
3. All membrane flashings shall be installed concurrently with the waterproofing membrane as the job progresses. Temporary flashings are not allowed without prior written approval from the Membrane manufacturer. Should any water penetrate the new waterproofing membrane because of incomplete flashings, the affected area shall be removed and replaced at the contractor's expense.
4. Provide a minimum vertical height of 8" for all flashing terminations. Flashing height shall be at least as high as the potential water level that could be reached as a result of a deluging rain and/or poor slope. Do not flash over existing through-wall flashings, weep holes and overflow scuppers.
5. All flashings shall be terminated as required by the Membrane Manufacturer.

B. Metal Flashing – General:

1. Metal flashings shall be fabricated in accordance with the current recommendations of SMACNA and in accordance with standard drawings and project details.
2. Metal flashing flanges to which membrane is to be bonded shall be a minimum of four (4) inches in width, and secured to the substrate six (6) inches on center staggered with fasteners appropriate to the substrate type. The flanges shall be provided with a roughened surface that has been cleaned of all oil and other residue.
3. Metal edges that will be overlaid with membrane shall be provided with a 1/4” min. hemmed edge.

4. Apply primer, resin and fleece to metal flange, extending membrane to outside face of metal edging, and to vertical face of metal base/curb flashing.

C. Membrane Flashing – General:

1. Membrane flashings shall be fabricated with primer appropriate for the substrate surface, flashing grade type resin of the same base chemical type as the field membrane, and fleece of the same weight as the field membrane unless specified otherwise.
2. Primer, resin, and fleece mixing and application methods as specified for field membranes are also suitable for membrane flashing grade.
3. Fleece shall overlap 2” (5 cm) minimum for all joints. Fleece shall be cut neatly to fit all flashing conditions without a buildup of multiple fleece layers. Work wet membrane with a brush or roller to eliminate blisters, openings, or lifting at corners, junctions, and transitions.

D. Pipes, Conduits, and Unusually Shaped Penetrations:

1. Flash all penetrations using cold fluid-applied reinforced polymethyl methacrylate roof membrane. Flashing material shall be resin as specified by membrane manufacturer with appropriate fleece reinforcement.
2. Flashing is typically constructed as a two-part assembly consisting of a vertical wrap and a horizontal target patch. There must be a minimum of a two (2) inch (5 cm) overlap between vertical and horizontal flashing components.

E. Drains and Scuppers:

1. Acceptable drain and scupper materials are cast iron, cast aluminum, and copper.
2. Connect new drains and scuppers to existing storm sewer system.
3. Alternatively, replace all broken or damaged parts of existing drains and scuppers, or provide and install an acceptable insert.
4. Flash drains and scuppers using cold fluid-applied reinforced polymethyl methacrylate roof membrane. Flashing material shall be the same resin used in the field membrane with fleece reinforcement.
5. Flashing material shall extend four (4) inches minimum onto drain, scupper, or insert flange.
6. Install clamping ring if provided as part of the drain or scupper design. Install a strainer basket to prevent debris from clogging the drainage line.

F. Hot Stacks:

1. Protect the membrane components from direct contact with steam or heat sources when the in-service temperature exceeds 150 °F. In all such cases flash to an intermediate "cool" sleeve.
2. Fabricate "cool" sleeve in the form of a metal cone using galvanized metal in accordance with Membrane manufacturer’s details.
3. Flash all penetrations using cold fluid-applied reinforced polymethyl methacrylate roof membrane. Flashing material shall be resin as specified by membrane manufacturer with appropriate fleece reinforcement.

4. Flashing is typically constructed as a two-part assembly consisting of a vertical wrap and a horizontal target patch. There must be a minimum of a two (2) inch (5 cm) overlap between vertical and horizontal flashing components.

G. Flexible Penetrations:

1. Provide a weathertight gooseneck of round cross-section for each penetration or group of penetrations. Set in Water cut-off mastic and secure to the structural substrate.
2. Acceptable gooseneck material is copper, of a sheet weight appropriate for the application.
3. Flash all penetrations using cold fluid-applied reinforced polymethyl methacrylate roof membrane. Flashing material shall be resin as specified by membrane manufacturer with appropriate fleece reinforcement.
4. Flashing is typically constructed as a two-part assembly consisting of a vertical wrap and a horizontal target patch. There must be a minimum of a two (2) inch (5 cm) overlap between vertical and horizontal flashing components.

H. Walls, Curbs and Base Flashings:

1. Wall, curb and base flashings shall be installed to solid substrate surfaces only. Adhering to gypsum-based panels, cementitious stucco, synthetic stucco, wood or metal siding and other similar materials are not acceptable.
2. Flash all walls, curbs and base flashings using cold fluid-applied reinforced polymethyl methacrylate roof membrane. Flashing material shall be resin as specified by membrane manufacturer with appropriate fleece reinforcement.
3. Reinforce all transition locations and other potential wear areas with a four (4) inch wide polyester fleece bottom layer evenly positioned over the transition prior to installing the exposed flashing layer.
4. Reinforce all inside and outside corners with a four (4) inch diameter conical piece of fleece prior to installing the exposed flashing layer.
5. All pins, dowels and other fixation elements shall be flashed separately with a vertical flashing component prior to installing the exposed flashing layer.
6. Extend flashing a minimum of four (4) inches onto the field substrate surface.

I. Drip Edges and Gravel Stops:

1. Metal drip edges and gravel stops shall be installed to solid substrate surfaces only. Securement to gypsum-based panels, cementitious stucco, synthetic stucco, wood or metal siding or coping and other similar materials is not acceptable.
2. Flash all drip edges and gravel stops by extending the field membrane all the way to the edge of the exposed face prior to installing the metal edging. Strip in the metal flange with a separate 8-inch wide strip of membrane adhered to both the securement flange and to the field membrane.
3. For conditions where water infiltration behind the exposed drip edge or gravel stop face is possible, install a separate polyester fleece bottom layer positioned behind the face area and extending a minimum of four (4) inches past the securement flange onto the field substrate prior to installing the drip edge or

gravel stop.

J. Field Fabricated Control or Expansion Joint Flashing:

1. Control or expansion joints in excess of two (2) inches in width require the use of a separate engineered joint system.
2. Control or expansion joints two (2) inches or less in width may be flashed with two layers of cold fluid-applied reinforced polymethyl methacrylate roof membrane and a compressible foam or rubber insert. Use a polyester reinforcing fleece bottom layer as and polyester fleece top layer.
3. Grind or otherwise bevel the inside edges of the joint opening to provide a smooth transition edge for the fleece.
4. Flashing typically consists of a polyester reinforcing fleece bottom layer looped into the joint as a cradle, a compressible foam or rubber insert at 25% compression fitted into the joint, and a polyester fleece top layer applied over the joint. Extend both fleece layers four (4) inches minimum onto the field substrate on both sides of the joint.
5. Apply the field membrane over the entire joint area.

K. Electrical Conduit, Gas Lines and Lightning Protection

1. Supports for electrical conduit and gas lines greater than one (1) inch in diameter require the use of a separate engineered support system.
2. Supports for electrical conduit and gas lines one (1) inch or less in diameter, and bases for lightning protection rods and cable, can be adhered directly to the membrane surface with a single-component, high quality polyurethane sealant.

3.07 TRAFFIC-BEARING SURFACING AND FINISHES

A. Approved Coating-Type Slip-Resistant Finish Surfacing

1. Where specified, provide and install approved polymethyl methacrylate self-leveling coating resin over clean, fully cured membrane in accordance with manufacturer's written instructions and details. Product shall be applied with a smoothing trowel to achieve a smooth and level surface. All unevenness and membrane overlaps shall be smoothed out.
2. Broadcast kiln-dried quartz aggregate or colored ceramic aggregate surfacing at a rate recommended by manufacturer into wet surface of coating to provide slip-resistant protective surfacing. Avoid any traffic for a minimum of two (2) hours to allow for surfacing to cure. Remove all excess and loose quartz surfacing with broom, vacuum and/or oil-free blower.
3. Seal natural quartz silica aggregate surfacing with pigmented topcoat sealer coating in accordance with manufacturer's written instructions and details. Seal colored ceramic silica aggregate surfacing with a translucent topcoat sealer coating in accordance with manufacturer's written instructions and details. Product shall be applied with a rubber flat blade squeegee and lambswool roller to achieve a uniform surface. Avoid any traffic to allow for coating to cure as per membrane manufacturer recommendations.

B. Approved Coating-Type Chips Finish Surfacing

1. Where specified, provide and install approved polymethyl methacrylate self-leveling coating resin over clean, fully cured membrane in accordance with manufacturer's written instructions and details. Product shall be applied with a smoothing trowel to achieve a smooth and level surface. All unevenness and membrane overlaps shall be smoothed out.
2. Apply pigmented topcoat sealer coating in accordance with manufacturer's written instructions and details. Product shall be applied with a lambswool roller to achieve a smooth and level surface.
3. Broadcast the approved chip flakes into the wet pigmented topcoat by hand and/or hopper spray gun at a membrane manufacturer recommended rate. Avoid any traffic to allow for coating to fully cure as per membrane manufacturer recommendations and sweep or air-blow away any excess of loose chips.

C. Approved Coating-Type Texturized Finish Surfacing For Ramps

1. Where specified, provide and install approved polymethyl methacrylate self-leveling coating resin over clean, fully cured membrane in accordance with manufacturer's written instructions and details. Product shall be applied with a smoothing trowel to achieve a smooth and level surface. All unevenness and membrane overlaps shall be smoothed out. Avoid any traffic to allow self-leveling coating to fully cure. Apply texturized coating in accordance with manufacturer's written instructions and details. Product shall be applied with a smoothing trowel to achieve a uniform surface. Avoid any traffic to allow for texturized coating to fully cure.

D. Alkalinity Protection

1. Polymethyl methacrylate resin is alkalinity resistant unless otherwise stated by the membrane manufacturer. If required, additional bond/wearing layer consisting of one application of manufacturer approved resin on horizontal/vertical surfaces and one application of approved broadcast mineral aggregate surfacing shall be applied wherever stone, concrete, or masonry elements will be placed directly over the flashing to improve adhesion of the overburden materials to the membrane surface.

3.08 TEMPORARY CLOSURES & WATERSTOPS

A. Contractor shall be responsible to ensure that moisture does not damage any completed section of the new waterproofing system. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition. All temporary closures shall be made as recommended or required by the membrane manufacturer.

3.09 PROTECTION

A. Upon completion of waterproofing and flashings (including all associated work), institute appropriate procedures for surveillance and protection of roofing during

remainder of construction period. Protect all areas where membrane has been installed.

3.10 CLOSEOUT

A. Correction of Work:

1. Work that does not conform to specified requirements including tolerances, slopes, and finishes shall be corrected and/or replaced. Any deficiencies of membrane application, termination and/or protection as noted during the Membrane manufacturer's inspections shall be corrected and/or replaced at Contractor's expense.

B. Clean-Up:

1. Site clean-up, including both interior and exterior building areas that have been affected by construction, shall be restored to preconstruction condition.

END OF SECTION

SECTION 075600 - FLUID-APPLIED PROTECTED MEMBRANE ROOFING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide all fluid-applied roofing system Work, in a protected membrane configuration, as indicated on the Drawings and as specified herein, including but not limited to the following:

1. Reinforced fluid-applied roofing membrane
2. Protection Sheet
3. Flexible uncured neoprene flashing
4. Parapet waterproofing/flashing
5. Drainage panels
6. Rigid Insulation
7. Filter fabric
8. Precast concrete pavers
9. All required primers and accessories
10. Testing of membrane integrity by Low-Voltage Electric Integrity Testing (LVEIT) methodology, such as EFVM by International Leak Detection.

1.2 REFERENCES

A. References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

B. American Society for Testing and Materials (ASTM).

C. Underwriters Laboratories, Inc. (UL).

D. National Roofing Contractors Association (NRCA).

E. Thermal Insulation Manufacturers Association (TIMA).

F. Factory Mutual Global (FM)

H. Canadian Government Specification Board (CGSB)

I. United States Environmental Protection Agency (EPA)

1.3 SUBMITTALS

A. Miscellaneous Submittals and Product Data

1. Submit manufacturer's complete technical and installation literature for all materials of this Section.

2. When the roofing and flashing system of a proposed manufacturer incorporates materials, details, or installation methods which differ from those indicated in the Specifications or Drawings, submit complete product information for consideration by the RIOC, as required by Specifications Division 1, and the General Conditions. Submit information prior to start of any Work which would be affected by the proposed substitutions.

3. Submit membrane manufacturer's requirements for characteristics of concrete substrate, prior to start of Cast-in-Place Concrete work.

4. Submit written approval from membrane manufacturer confirming compatibility of the roofing system with the specified concrete roof deck and fill materials, prior to start of Cast-in-Place Concrete work.

5. Manufacturer's Warranty: Sample copy of the membrane manufacturer's 20 year warranty covering workmanship and materials, conforming to requirements of this Section.

B. Shop Drawings

1. Submit installation details for roofing systems to show, at a minimum, details at drains, at reinforcing, at flashing, at terminations, at joints in structure below, at intersection of horizontal and vertical surfaces, at penetrations, and at roof parapets.

a. Submit for typical and non-typical conditions of Project. Manufacturer's standard data sheets are not acceptable for shop drawings.

b. Indicate and identify materials to be incorporated in the work, dimensions, thickness of each materials and system, and relationships to adjacent construction.

c. When there is a proposed deviation from the Contract Documents, submit the revised detail labeled as such for approval.

2. Roof membrane manufacturer shall review and approve roof detail shop drawings submitted for Work of Section 07600, Flashing and Sheet Metal, prior to review by the RIOC.

C. Survey

Submit a survey of substrate and drain elevations as described in Article titled “Survey”.

D. Samples: Submit the following, with manufacturer's printed product identification on each item:

1. Insulation Material: 12" x 18".

2. Drainage panel: 12” x 12”.

3. Precast Concrete Paver Units and Accessories.

4. Flashing and Reinforcing Materials: Each type and thickness required for project, minimum 12" long.

5. Fabric Sheets: Each type required for project, 12" x 12".

6. Roofing membrane materials: each type required for the project.

7. Protection sheet: 12” x 12”.

8. Test Strips: If requested by the RIOC. As specified under Article titled “Test Strips”.

E. Quality Control Submittals

1. Fire Hazard Certification:

a. Written certification that the roof system, including the specific insulation, has been tested in conjunction with the type of structural roof deck and roof slope applicable to the project and has achieved an Underwriters Laboratories Class A external fire resistance rating.

b. Certification: Letter from Underwriters Laboratories, or a copy of the Underwriters Laboratories classification listing for the roofing system.

2. Material Certifications:

a. Letter from the roofing membrane manufacturer certifying that the insulation, drainage composites, and other such materials are approved for use with the roofing system.

b. Certification of an approved independent testing laboratory certifying that the membrane material meets the specified ASTM and CGSB standards.

c. Letter from the roofing membrane manufacturer certifying that the submitted materials and installation instructions are in conformance with the latest roofing system specifications of the manufacturer.

d. Certification by an approved independent testing laboratory certifying that the precast concrete pavers proposed for the project conform to specified requirements for solar reflectance.

3. Membrane Manufacturers Certifications:

a. Submit a letter certifying that the manufacturer has been actively marketing the submitted system for a minimum of ten years.

b. Submit the names and addresses of five roofing projects of same size and scope as this project, using this system, that have been in service for at least 10 years. .

4. Applicator's Certification:

a. Letter from the membrane manufacturer certifying that the applicator is licensed or approved to install the specified roof system, and has been in operation applying the system for 5 years or more.

b. Names, address, and telephone numbers of five buildings where the applicator has installed the same type of fluid-applied hot rubberized asphalt roofing systems, which have the manufacturer's warranty issued. Include the types of roofing systems installed, the manufacturer's name, and the warranty numbers.

c. Letter certifying that the job foreman or crew chief and at least one other member of the roofing crew have installed at least five fluid-applied hot rubberized asphalt roofing systems and are thoroughly familiar with all aspects of the installation.

d. Evidence of job foreman training as specified under Article titled Quality Assurance.

e. Letter from manufacturer stating that the project is registered with the manufacturer. The Contractor is to bring this to the Pre-installation conference.

5. LVEIT testing firm qualifications

6. New York City Approval: Submit certification and listing by an Approved Agency in accordance with NYC Dept. of Buildings rules, indicating that the

materials and assemblies as regulated by the NYC Building Code are acceptable for the intended use. When test methods are stipulated in the NYC Building Code, the tests utilized shall be stated in the certification. Prior MEA (Material and Equipment Acceptance Division) approval is acceptable for materials conforming to current Code requirements.

Required Roofing System Rating: Class A.

F. LVEIT test reports

Test reports for each roof showing initial testing results and final testing results with statement that the roof test indicates no breeches.

G. Contract Closeout Submittals

1. Membrane manufacturer representative's certification of completed roof system: As specified.

2. Guaranty and Warranty: As specified.

H. Sustainability Submittals

1. Recycled Content

a. Submit documentation of recycled content consisting of product data or manufacturer's statement as applicable for the following:

1) Roofing membrane material.

2) Extruded foam insulation (if containing recycled content).

1.4 QUALITY ASSURANCE

A. Membrane Manufacturer's Qualifications

1. The manufacturer shall have the technical expertise and qualified technical representatives to promptly resolve questions or problems which may arise both during and after the Work is completed.

2. The manufacturer shall have been actively marketing a fluid-applied rubberized asphalt roof system for a minimum of five years.

3. The manufacturer shall provide the names of at least five previous projects of comparable size, scope, and complexity as the Work of this Section.

4. The manufacturer must require that the roof system be installed by a licensed or approved applicator.

B. Roofing Installation Qualifications

1. Roofing Firm Qualifications

a. Installation of a minimum of ten fluid-applied roofing systems including all related sheet metal work.
(List last five such jobs, including address, type of system, square footage, date installed and owner/agent with whom contracted).

b. In continuous operation of installing the specified roofing system for five years or more.

c. Certified installer for nationally recognized roofing materials manufacturer.

2. Project Foreman Qualifications

(Note: For field foremen to be assigned to this Project, identify and substantiate).

a. Installation of a minimum of five fluid-applied roofing systems for which this individual served as field foreman in direct responsible charge of all roofing work crews.

(Note: List last five such jobs, including address, type of system, square footage, date installed and owner/agent with whom contracted, and name of roofing firm with which employed).

b. Successful completion of a formal instructional and training program for the installation of the specified roofing systems, as evidenced by:

1) A certificate of journeyman roofer as issued under a union apprenticeship-journeyman training program duly registered with the New York State Department of Labor (or other State Labor Department); or

2) A certificate or diploma issued by a vocational training school or national roofing manufacturer attesting to successful completion of an equivalent formal training program, (Submit copy of certificate for above); or

3) A minimum of five years of practical experience in the installation of all aspects and details of the specified roofing system(s) including related sheet metal work as determined from a pre-qualification interview conducted by the RIOC's Construction Inspection Division.

c. Must be able to read and communicate in English and be able to read construction drawings and specifications.

C. Low-Voltage Electric Integrity Testing (LVEIT) Firm Qualifications

Engage the services of an LVEIT Consulting firm to perform testing of all membranes. Obtain from the membrane manufacturer the name of an LVEIT firm(s) they will accept to provide the report that will used as part of the basis for the membrane manufacturer issuing the warranty. The firm shall have no less than a 5 year track record in the use of LVEIT technology.

D. Buildings Department Requirements

Comply with all requirements of the New York City Department of Buildings.

E. Fire Department Regulations

Equipment and fuel shall meet the requirements of the New York City Fire Department.

F. Fire Hazard Classification

1. The roof system shall have an Underwriters Laboratories Class A External Fire Resistance rating.

2. The roof system, which includes a specific generic type of insulation and in some instances a specific name brand insulation, shall have been tested in conjunction with the type of structural roof deck and roof slope applicable to the project.

G. Company Field Advisor

Secure the services of a Company Field Advisor of the membrane manufacturer for a minimum of 30 working hours. The Field Advisor shall be certified in writing by the manufacturer to be technically qualified in design, installation, and servicing of the required products. Personnel involved solely in sales do not qualify. The Field Advisor shall be present at the Pre-Installation Conference and at the beginning of the actual membrane installation for the purpose of:

1. Verifying that conditions are satisfactory for installation of the membrane.

2. Rendering technical assistance to the Contractor regarding installation procedures of the system.

3. Familiarizing the RIOC's Representative with all aspects of the system including inspection techniques.

4. Answering all questions which might arise.

The Field Advisor shall also make, at a minimum, weekly visits during the active installation of the Work, and shall certify roof upon completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials: Materials shall be delivered to the project site in manufacturer's unopened containers with manufacturer's brand name, instructions for use, all identifying numbers, New York City MEA numbers, and U.L. labels clearly marked thereon.

B. Storage

1. Store containers of materials on end, on wood or other clean rigid pad, a minimum of 6" off the ground, to prevent adherence of foreign material. Roll goods shall be stored on end in unopened packages.

2. Store in a neat, safe manner, clean and dry, protected from water, sunlight, excessive heat and humidity and open flame.

3. Temperature of storage area for adhesives shall be between 60°F and 80°F, or as otherwise recommended by the manufacturer.

1.6 PROJECT CONDITIONS

A. Environmental

1. Weather: Roofing systems shall not be applied in wet weather nor when frost or ice is on surfaces to receive work of this Section.

2. Temperature: Surface and air temperature shall be as recommended in writing by manufacturer of the materials being installed.

B. All surfaces to receive the membrane shall be free of water, dew, frost, snow, ice, or moisture of any kind, debris, and dust.

C. Preparation and application of membrane must be conducted in well ventilated areas.

D. After installation do not expose membrane to temperatures in excess of 180°F.

E. Do not use adhesives near an open fire. Do not use in confined areas without adequate ventilation. Consult container or packaging labels and Safety Data Sheets (SDS) for specific safety information.

F. Do not allow waste products (petroleum, grease, oil, solvents, vegetable or mineral oil, animal fat, etc.), or foreign chemicals or materials, to come in contact with the roof membrane.

1.7 SURVEY

A. Prior to proceeding with the Work of this Section, confirm that all roof substrate surfaces are uniformly sloped to drains.

B. Submit a complete survey prepared, signed and sealed by a New York State Licensed Surveyor. The cost of the Surveyor's services shall be included in the Contractor's bid price.

C. Elevations shall be taken at the perimeter of roofs, at all drains and bottom of scuppers, at high and low spots, and on the edges of square grid not exceeding 10'-0".

D. All drawings shall be done at the scale of 1/8" = 1'-0". All elevations shown on the drawings shall be referred to a convenient datum accessible at all times regardless of the stage of Work, and not altered by the Work.

E. Bring all deviations from proper slope to the attention of the Architect or Engineer of Record. The A/E of Record will determine the process required to remediate the condition. Minor depressions and irregularities in the substrate that are found to be acceptable by the membrane manufacturer's Company Field Advisor may be permitted subject to the concurrence of the RIOC's representative.

1.8 CONTRACTOR'S GUARANTEE

A. The Contractor agrees as part of this Contract that all Roofing, Flashing, Sheet Metal Work, Parapet, Coping, and the entire envelope of the roofing system of this contract will be watertight and free from defects due to workmanship and material for a period of two years. Time of guarantee shall commence with approval of the substantial completion payment for the Work, or the final payment for the work if no substantial completion payment is made.

B. Should any defects develop or any leaks occur during the period of guarantee, such defects or leaks shall at once be remedied and all damage caused by such defects or leaks shall be repaired and corrected without cost or expense to the RIOC.

C. In the event of failure on the part of the Contractor to commence within three (3) days after the notification by the RIOC, any Work required to be performed under the terms of the this guarantee, and to complete the same within a reasonable time thereafter, the RIOC may have such work done by other parties and charge the cost thereof to the Contractor and the Surety herein.

D. The Performance Bonding Company's guarantee shall be for the entire two year guarantee period.

1.9 ROOFING SYSTEM GUARANTEE/WARRANTY (ROOFING MANUFACTURER)

A. Furnish the roofing system manufacturer's twenty (20) year single-source warranty for the Work of this Section. The warranty shall include, but not be limited to, repair of

leakage caused by defects in materials and workmanship. The monetary value of the warranty shall be at least equal to the original cost of the installation; including labor, materials and equipment.

B. The roof system shall be warranted to remain watertight for twenty years.

C. All components of the roof system, including but not limited to membrane, flashing, parapet waterproofing, protection course, reinforcement, drainage panels, insulation, filter fabric, and pavers shall be covered under the warranty. Pavers shall be covered for 10 years; all other components shall be covered for 20 years. In the event that defects or leaks occur the manufacturer will make repairs to correct them.

D. This warranty is in addition to the Contractor's guarantee described in this Section.

1.10 PROTECTION

A. Against Loads: Protect work of this Section against concentrated loads and any other loads or equipment that would damage the materials or work. Use insulation and 3/4" thick minimum plywood or other approved means to safely distribute the loads.

B. Against Traffic: Do not permit traffic on work of this Section, except for workmen doing the work, during the installation and after the installation until membrane systems are protected. Use 3/4” thick minimum plywood and insulation for temporary pathways if required.

C. Rejection of Damaged Work

1. Materials or installed work damaged during project construction activities will be subject to rejection.

2. Rejected materials or work must be immediately removed and replaced with new materials, at no additional cost to the RIOC.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. The following manufacturer and product systems shall be construed to mean the establishing of a minimum quality and performance standards for the specified item. Minimum thicknesses are indicated but each manufacturer will have a specific minimum thickness that may be greater than that provided to meet the performance requirements and warranty provisions and must be provided if a thicker membrane is required.

1. American Hydrotech, Chicago, IL

2. SOPREMA, Inc., Wadsworth, OH

3. Barret Company, Millington, NJ

4. Tremco Inc., Beachwood OH

2.2 MATERIALS

A. Provide fluid-applied, rubberized asphalt, fabric reinforced, roofing system in the protected membrane configuration as indicated in the Drawings and Specifications. Material shall have integral SBS polymers.

B. Hot-Rubberized Asphalt System

1. Roof system shall meet or exceed such wind performance criteria as would be required to achieve the equivalent of a FM 1-90 classification.

2. Membrane: A hot applied, rubberized asphalt membrane meeting the following physical properties:

Properties	Test Method	Typical Value
Flash point	ASTM D92	475°F*
Low temperature crack bridging capability	CGSB-37.50 -M89**	No cracking, adhesion loss, or splitting
Water vapor permeability	ASTM E96, Procedure E CGSB-37.50 -M89	0.027 perm.
Water resistance 5 days/50°C	CGSB-37.50 -M89	No delamination, blistering, emulsification, or deterioration.
Water absorption	CGSB-37.50 -M89	Gain in weight: 0.22g max. Loss in wt.: 0.18g max.
Heat stability	CGSB-37.50 -M89	No change in viscosity, penetration, flow or low temperature.

Low temperature flexibility (-25°C)	CGSB-37.50 -M89	No delamination, adhesion loss or cracking.
Penetration	ASTM D5329	@ 77°F, max. 100. @ 122°F,max. 200.
Flow	ASTM D5329 CGSB-37.50 -M89	@ 140°F, 3.0mm max.
Softening point	ASTM D36	180°F
Elongation	ASTM D5329	1000% min.
Resiliency	ASTM D3407	40% min.
Bond to concrete	ASTM D3407	Pass 0°F
Solids content		100% - no solvents.
Shelf life		10 years (sealed containers)
Acid resistance	ASTM D896 Proc. 7.1 Note 8	Pass Nitric 50% Pass Sulfuric 50%
Toughness	CGSB-37.50 -M89	16.0 Joules
Ratio of toughness to peak load	CGSB-37.50 -M89	0.069
Viscosity	CGSB-37.50 -M89	11.0 seconds
Specific gravity		1.23

* not less than 77°F (25°C) above the manufacturer's maximum recommended application temperature.

** Canadian General Standards Board (CGSB)

3. Roofing membrane shall be manufactured with a minimum of 7% of post-consumer content materials.

4. Primer: An asphalt based primer for concrete surfaces meeting ASTM D41 as recommended by the manufacturer of the membrane.

5. Flashing/Reinforcing

   a. Manufacturer's PMMA, PUMA or urethane fleece reinforced flashing system for use at penetrations and flashings and/or capping of flashings where terminations are difficult.

   b. Modified bitumen SBS cap sheet (Torch grade), as used for full height flashing/waterproofing of parapets: 140 mils thick minimum, white granular surface. ASTM D6164 Type 1 Grade G. UL Classified.

   c. Flexible Flashing/Reinforcing: 60 mil thick uncured neoprene flashing/reinforcing sheet meeting the following physical properties; as recommended by the manufacturer of the membrane.

Property	Test Method	Requirement/Result	
Thickness			60 mil
Tensile Strength	ASTM D412	DIE C	1400 psi
Elongation	ASTM D412	DIE C	300% min.
Tear Resistance	ASTM D624	DIE C	125 lb/in. min.
Brittleness Temp. (-30°F)	ASTM D2137	Does not break	
Ozone Resistance	ASTM D1149	No Cracks	

6. Fabric Reinforcing Sheet: polyester fabric. Meet the following physical properties, or as recommended by the manufacturer of the membrane.

Property	Test Method	Requirement/Result
Elongation	ASTM D5726	42% min.
Tear Strength	ASTM D5726	6 lb.

Breaking Strength	ASTM D5726	22 lb.
De Matia Flex Cycles	ASTM D813	100,000

7. Adhesives/Sealant

   a. Contact adhesive used to bond flashing together; as recommended by the manufacturer of the membrane.

   b. Contact adhesive used to bond flashing to an approved substrate; as recommended by the manufacturer of the membrane.

   c. Sealant used to seal flashing seam edge; as recommended by the manufacturer of the membrane.

8. Protection sheet: A fiberglass reinforced, rubberized asphalt sheet, or other protection/separation course as recommended by the manufacturer of the roofing membrane and acceptable to the RIOC. Membrane to be 70 to 90 mils thick, as recommended by the membrane manufacturer for the roofing system configuration.

9. Subject to compliance with the requirements, provide:

   a. Monolithic Membrane 6125 FR EV, as manufactured and supplied by American Hydrotech, Inc., Chicago, IL.

   b. Henry 790-11 EV reinforced membrane system, as manufactured and supplied by Henry Company, El Segundo, CA.

   c. RamTough 250DM, as manufactured and supplied by Barrett Company, Millington, N.J.

   d. TREMproof 6100-25 fabric reinforced system, as manufactured and supplied by Tremco Inc., Beachwood OH.

2.3 AUXILLARY MATERIALS

A. General: Provide related waterproofing materials as manufactured by or acceptable to the membrane manufacturer, including drainage panels, insulation, filter fabric, protection sheet, and pavers.

B. Wood Nailers/Blocking

Pressure treated meeting the AWPA U1-15 standard, Use Class UC3A, #2 or better lumber.

C. Miscellaneous Fasteners

Appropriate for purpose intended and approved by membrane system manufacturer; length required for thickness of material (with metal washers); as supplied by membrane manufacturer.

D. Drainage Panels: Geotextile-faced composite drainage panels of type recommended by the manufacturer of the roofing system. Facing laminated to both sides of a nonbiodegradable molded plastic sheet drainage core. Flow rate not less than 7 gpm/ft per ASTM D4716. Compressive strength 30,000 psf minimum. Thickness approximately 0.25” to 0.5”.

E. Insulation: Extruded polystyrene rigid board insulation such as Styrofoam brand roofing insulation by Dow Chemical Co. or Foamular brand roofing insulation by Owens Corning as recommended by the manufacturer of the membrane and meeting the following physical properties:

1. Insulation shall meet ASTM C578, type VII.

2. Minimum compressive strength per ASTM D1621, 60 psi.

3. Maximum water absorption by volume per ASTM C272, 0.3%.

4. Water vapor permeance for 1" product per ASTM E96, 1.0 perm (max.)

5. Insulation shall have an R-value of 30, 5.0°F•ft^2•h/BTU (min.) per inch of thickness when tested at 75°F mean temperature in accordance with ASTM C518. Insulation manufacturer shall warrant product to retain at least 90% of original R-value for 15 years

6. Insulation shall not be produced with or contain any of the U.S. EPA regulated CFC compounds which are listed in the "Montreal Protocol".

F. Filter Fabric Sheet: Water permeable polymeric fabric, as recommended by the manufacturer of the membrane for filtering foreign materials and maintaining position of insulation boards.

G. Additional Materials: Provide cant strips, expansion joints, termination bars, edge strips, accessories, tapes, primer, cements, and sealants as recommended by manufacturer of fluid-applied membrane.

2.4 PRE-INSTALLATION CONFERENCE

A. Before the roofing Work is scheduled to commence, a conference will be called by the RIOC's Representative at the site for the purpose of reviewing the Drawings and the Specifications and discussing requirements for the Work. The conference shall be attended by the Contractor, the authorized roofing applicator, the membrane

manufacturer's Company Field Advisor, the RIOC's Construction Inspection Division inspector, the Architect/Engineer of Record's representative, and all trades that works penetrate or interface with the membrane(Plumbing, mechanical, electrical, lightning protection). The Contractor is to bring the manufacturer's letter stating the project has been registered with the manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that Work of other trades which penetrates the roof deck or requires personnel and equipment to traverse the roof deck has been completed and can be properly flashed.

B. Examine surfaces for inadequate anchorage, foreign material, moisture, and unevenness that would prevent the execution, and quality of application, of the system as specified.

C. Do not proceed with application of system until defects are corrected.

3.2 PREPARATION

A. Condition of Surfaces: Surfaces to receive membrane shall be free of defects or conditions that will interfere with, or prevent, a satisfactory installation of roofing systems and shall comply with ASTM D5295.

1. Concrete surfaces shall be at least 28 days old and otherwise sufficiently cured to receive membrane.

2. Verify with membrane manufacturer and test field conditions for moisture content of concrete prior to membrane installation. Utilize procedure recommended by roofing manufacturer (e.g. ASTM D4263, NRCA deck dryness test, with heated waterproofing, etc.) Decks shall be thoroughly dried out and free of moisture. There shall be at least 2 test areas for every 2500 square feet of area to be roofed. The RIOC's Representative shall be present at these tests and the test methods shall be acceptable to the RIOC.

3. All surfaces shall be free of depressions, voids, protrusions, cracks, holes, unevenness and other unsatisfactory conditions of substrates. Concrete must be monolithic, without spalled areas, honeycombs and sharp protrusions. Patching of substrates is not permitted unless written permission is issued by the membrane manufacturer. Minor depressions and irregularities in the substrate that are found to be acceptable by the membrane manufacturer's Company Field Advisor may be permitted subject to the concurrence of the RIOC's representative.

B. Contaminants

1. Surfaces shall be thoroughly cleaned and shall be free of water, dew, frost, dust, dirt oil, grease, concrete curing compounds, form release agents, laitance, and other foreign matter. Shotblast or sandblast if necessary to remove foreign materials, if so recommended by membrane manufacturer.

2. Dirt and dust shall be completely removed with an air compressor or industrial type vacuum cleaner or methods approved by membrane manufacturer so the surface shall pass a blue cloth test.

C. Other Work

Coordinate with installation of cap flashings, copings, metal edge trims and work as specified in Section 07600, Flashing and Sheet Metal.

3.3 JOINTS, CRACKS, AND TERMINATIONS

A. Prepare and treat substrates to receive membrane, including joints and cracks, drains, and penetrations, according to CGSB-37.51, "Application of Rubberized Asphalt, Hot-Applied, for Membrane and Waterproof membrane," and membrane system manufacturer's written instructions.

1. Rout and fill joints and cracks in substrate. Before filling, remove dust and dirt according to ASTM D4258.

2. Moving Joints: Adhere strip of elastomeric flashing sheet to substrate in a layer of hot fluid-applied, rubberized asphalt. Extend flashing sheet a minimum of 6 inches on each side of moving joints and cracks or joints and cracks exceeding 1/8 inch thick, and beyond drains and penetrations. Apply second layer of hot fluid-applied, rubberized asphalt over elastomeric flashing sheet.

3. Non-Moving Joints: Embed strip of reinforcing fabric into a layer of hot fluid-applied, rubberized asphalt. Extend reinforcing fabric a minimum of 6 inches on each side of nonmoving joints and cracks not exceeding 1/8 inch thick, and beyond drains and penetrations.

a. Apply second layer of hot fluid-applied, rubberized asphalt over reinforcing fabric.

B. At expansion joints and discontinuous deck-to-wall or deck-to-deck joints, bridge joints with elastomeric flashing sheet extended a minimum of 6 inches and 12 inches on each side of joints and adhere to substrates in layers of hot fluid-applied, rubberized asphalt. After installing foam expansion rod, apply second 12 inch sheet of elastomeric flashing over the foam rod and 6” sheet. Apply third layer of hot fluid-applied, rubberized asphalt over elastomeric reinforcing sheet.

3.4 INSTALLATION - PRIMER, REINFORCING, FLASHING, MEMBRANE, PROTECTION

A. Primer

1. Apply surface conditioner/primer to the concrete substrate evenly, at a rate recommended by the membrane manufacturer. Avoid excessive application. Ponding of the primer is not acceptable.

2. Allow sufficient time for the primer to thoroughly dry prior to the membrane application.

3. If primer is contaminated by dust, construction traffic or other sources, reprime as recommend by the manufacturer.

4. Prime and prepare parapet as recommended by the membrane manufacturer for application of full height flashing/waterproofing.

5. All metal flashing shall be bright metal clean, free of process oils and treated with conditioner/primer as recommended by the membrane manufacturer.

B. Reinforcing

1. Apply reinforcing to joints, cracks, changes in plane, and elsewhere as recommended by the membrane manufacturer.

C. Detailing/Flashing

1. All preparation of substrates and all detailing and flashings shall be done in accordance with the membrane manufacturer's printed instructions and as shown on the Drawings.

2. All detailing and flashing shall be completed before installing the membrane over the field of the substrate. Obtain prior written approval of the Project Architect or Engineer for conditions where the flashing assembly is properly installed in a different sequence.

3. Apply flashing at roof penetrations, vertical surfaces, drains, curbs, edges, and wherever required for a proper installation.

4. Provide flashing/waterproofing for the full height of parapets as indicated on the Drawings, and in accordance with the membrane manufacturer’s written instructions. Materials and installation shall be as recommended by the membrane manufacturer as required for inclusion in the single source roof system warranty.

   Flashing/waterproofing assembly shall consist of one of the following, subparagraph a., b. or c. as recommended by the membrane manufacturer, and as indicated on approved Shop Drawings:

a. Uncured neoprene flashing, 60 mils thick, adhered to back of parapet with membrane manufacturer's bonding adhesive or hot-rubberized asphalt; totally adhered without wrinkles. Provide termination bar and cap flashing as indicated on the Drawings. Where height of flashing on parapet exceeds 4'-0", or as recommended by the manufacturer, provide an intermediate termination bar at recommended height above concrete roof deck, and splice flashing as recommended by the manufacturer, with a six inch adhered lap covering the termination bar.

D. Membrane

1. The membrane shall be heated in a double jacketed, oil bath melter, air jacketed melter, or other type of melter as approved by the RIOC, with mechanical agitator and safety shutoff, specifically designed for the preparation of a rubberized asphalt membrane. Melter shall be equipped with thermometer and foreman shall record on a chart the temperatures to which materials have been heated; submit chart at end of each day to the RIOC's Representative. Only one fuel container shall be on the roof at any one time, and it shall be removed at the end of the working day. Locate the container at least four feet away from the melter. Brace the container and shade it from the sun.

2. Provide fire extinguishers on the roof in the vicinity of the melters as required to ensure the safety of the roof.

3. Directives of the NYC Fire Department for locations of equipment take precedence over locations stated herein.

4. Heat membrane until the material can be drawn, free flowing, at a temperature range stated in the membrane manufacturers written instructions. In no case shall material be heated above maximum temperature recommended by the manufacturer.

5. Apply the rubberized asphalt membrane at a rate to provide a continuous, monolithic coating of 90 mil minimum, into which fully embed a layer of the fabric reinforcing sheet, followed by another continuous monolithic coat of membrane at minimum thickness of 125 mil. Total minimum thickness: 215 mils. Apply membrane smooth, free from air pockets, or wrinkles. Ensure full bond of membrane to substrate.

6. Overlap fabric reinforcing sheet at least 2", and in accordance with the membrane manufacturer's instructions.

E. Separation/Protection Layer

1. Embed protection sheet into the membrane while it is still warm if recommended by membrane manufacturer.

2. Overlap adjoining sheet edges to ensure complete coverage.

3. Cover sheet with drainage panels, insulation, filter fabric and ballast within time period recommended by membrane manufacturer, and not to exceed 30 days.

F. Perform LVEIT and flood testing as specified in Articles below prior to installation of insulation. If breaches or leaks are found, drain water completely, make all necessary repairs, and retest.

3.5 INSTALLATION – DRAINAGE PANELS, INSULATION, FILTER FABRIC, BALLAST

A. General: Examine the roof area to be covered with subsequent topping materials in order to ensure that all roof areas have received the membrane, the membrane is free of damage, it is properly protected, and all flashing has been properly installed, before placing the insulation. Installation of all components shall be in accordance with the written instructions of the membrane manufacturer. Do not begin installation until the LVEIT and flood testing has been completed and membrane accepted.

B. Drainage Panels

Place drainage panels over protection sheet according to manufacturer's instructions, and without penetrating the waterproofing membrane. Drain cores shall directly abut each other. Lap geotextile to maintain continuity.

C. Insulation

1. Loose lay in a staggered manner and tightly butt together all insulation boards. Occasional joint widths of up to 1/8" will be allowed. Insulation shall be installed within 3/4" of all projections, penetrations, and other discontinuities in the roofing system.

2. Install insulation to achieve the required R-value indicated in the Documents. Where total insulation thickness is more than 2", install the required thickness in two or more layers with joints of each succeeding layer staggered over joints of previous layer a minimum of 6" in each direction. The bottom layer of insulation shall be the thickest layer and shall be at least 2" thick. Layers shall be installed unadhered to each other.

D. Drainage Panels

Place on top of insulation where spacers/pedestals are not used to support pavers.

E. Filter Fabric: Install fabric over the insulation as described below. Include additional provisions as required to prevent insulation boards from shifting out of position if the roof is flooded:

1. Overlap all edges a minimum of 1'-0". Do not use lengths less than 6'-0".

2. Install fabric so that no joints will exist between the sheets parallel to and within 6 feet of the roof perimeter.

3. Extend fabric above the ballast at the perimeter and penetrations. The dimension of the extension above the ballast and the method of terminating and securing the fabric shall be as instructed by the membrane manufacturer.

4. Extend fabric to drain bases or bonnets, but do not cover drains or restrict water flow to the drains.

5. Install additional fabric around all penetrations in order to prevent foreign material entry into the space between the penetration and the insulation.

3.6 LVEIT PROCEDURE

A. After completion of the fluid-applied roofing membrane, but prior to flood testing and installation of insulation and other items, test watertightness of installation by performing an LVEIT. Survey shall conform to ASTM D7877.

B. Once membrane has met all previously required inspection and testing requirements, the Contractor's LVEIT consultant shall install the conductor cable on the surface of the finished membrane and secure in a method as directed by the testing consultant. This cable is to be considered part of the Work of the project and shall remain in place at the completion of the testing for future use by the Department of Education. The membrane shall then be wetted and field energized and the LVEIT consultant shall walk the roof areas while assessing the field for breaches and defects.

C. All breaches shall be marked on the membrane by the LVEIT consultant and repair shall be completed by the Contractor. The test shall be performed again to verify all breeches have been remedied. A formal report of all tests is to be submitted indicating all findings/areas of failure as well as photographic documentation and drawing of the test area.

D. Once tested and no failures noted, the membrane shall be protected and the flood test performed. Upon completion of entire roof system, the roof shall be retested using the same LVEIT procedure as described above.

3.7 FLOOD TEST

A. After completion of the LVEIT procedure but prior to installation of insulation and the remainder of the system, test watertightness of installation by plugging drains and flooding with water to a minimum depth of 1" above the high points for a period of 24 hours. For each flood test performed, the Contractor shall notify the RIOC's field representative when the minimum 1" of water above high point has been reached to mark the start of test period for verification and notification to the RIOC's Construction Inspection Division to allow for inspection.

B. Where roofing work is limited to areas immediately adjacent to parapets or other partial roof replacement areas, the flood test shall include the area of new work and extend at least an additional 4 feet past the transition to the existing membrane. If there are steep areas of roofing or the water level will exceed 6" at any point, create dams to provide flood testing of the roof in sections.

C. If leaks occur, the water shall be drained completely; the membrane installation shall be repaired, and then re-tested. Continue repair and re-testing until installation is leak-free.

D. Give written notice to the RIOC's Representative at least one week prior to the scheduled date for water testing. Do not conduct test without presence of the Representative. Test shall be conducted prior to installation of the ceiling under the roof.

3.8 TEST STRIPS

A. Test Strip (if requested by the RIOC)

When and where directed by the RIOC's Representative, and before insulation is installed over the completed membrane, cut a strip thru all plies of the roofing membrane. Number of such test strips may be as required by the Representative. After removal of the strip, immediately repair the area in accordance with instructions of the membrane manufacturer. Turn the test strips over to the RIOC's Representative for examination.

If the test strips indicate the roofing system complies with the Specifications, the RIOC will bear the cost of the test strip Work.

If the strips indicate the roofing system does not comply with the Specifications, the Contractor shall bear the cost of the test strip Work, and shall repair or replace all roofing Work as required to comply with the Specifications, at the Contractor's expense.

Failure of the test strip samples to meet the Specification requirements will be cause for rejection of the Work.

3.9 JOB COMPLETION

A. Contractor shall inspect the completed roof system assembly and correct all defects.

B. A representative of the membrane manufacturer (Company Field Advisor) shall inspect the roof system assembly and notify the contractor of any defects. All defects must be corrected. The representative shall submit written certification to the RIOC that representative has consulted on and inspected the work and that the materials and installation are in conformance with the manufacturer's published physical properties and installation recommendations and with the Contract Documents.

C. Clean up all debris and equipment. Remove spatters and clean soiled surfaces. Check drains to ensure proper function.

END OF SECTION 075600

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SECTION 076000 - FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide all flashing, trim and sheet metal Work as indicated on the Drawings, as required for the completed Work, and as specified herein. The Work shall include, but shall not be limited to, the following:

1. Roof Flashings (various types)
2. Wall Flashings (various types)
3. Shop-Formed Copings
4. Gutters and Downspouts
5. Flashing at roof mounted equipment and roof penetrations.

1.2 REFERENCES

A. References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

B. Sheet Metal and Air Conditioning Contractors National Association (SMACNA).

C. Copper Development Association (CDA).

D. American Society for Testing and Materials (ASTM).

E. Federal Specifications (FS).

1.3 SUBMITTALS

A. Shop Drawings

1. Show the manner of forming, jointing, and securing the metal flashings, trim, and other specified sheet metal items. Include expansion joint connections, and the method of forming waterproof connections to adjoining construction.

2. Submit roof plan indicating layout and spacing of snow guards as recommended by the snow guard manufacturer. Include half full size detail of snow guard type and method of attachment.

B. Product Data

1. Catalog sheets, specifications, installation instructions for each item specified except for shop or job formed items, solder and flux.

2. Manufacturer's recommendations for installation and spacing of snow guards.

C. Samples

1. Materials for Flashings: One 6" sq piece, for each type material specified.

2. Anchors: Two, each type required.

3. Cap Flashings: Full section, 6" long.

4. Coping: Full section, 12" long.

5. Gutters: Full section, 12" long.

6. Downspout: Full section, 12" long.

D. Guarantee

E. Certificates of qualifications as specified under Article titled “Quality Assurance”.

F. Product Certificates

Certify that materials of this Section, such as copper/fabric flashing, sealants, termination bar, and fasteners, are compatible with all components of the air barrier system and other Project materials that contact them.

1.4 QUALITY ASSURANCE

A. Except as otherwise shown or specified, comply with applicable recommendations, details, and standards of CDA, and SMACNA.

B. All metal Work shall be ink-stamped at intervals, identifying

Manufacturer, type metal, and gage or thickness.

C. Manufacturer's Recommendations

For factory fabricated items, follow the manufacturer's recommendations and installation instructions unless specifically shown or specified otherwise.

D. Materials containing asbestos are prohibited.

E. Project Foreman Qualifications

1. Successful completion of a formal instructional and training program for the installation of the specified roofing/flashing systems, as evidenced by:

a. A certificate of journeyman roofer as issued under a union apprenticeship-journeyman training program duly registered with the New York State Department of Labor (or other State Labor Department); or

b. A certificate or diploma issued by a vocational training school or national roofing manufacturer attesting to successful completion of an equivalent formal training program. (Submit copy of certificate for above).

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products of this Section in such manner to protect them from damage.

1.6 PROJECT CONDITIONS

A. Do not execute the Work of this Section unless the RIOC's Representative is present, unless otherwise directed.

B. Make the roof and all uncompleted flashings watertight at the end of each work day.

1.7 GUARANTEE

A. The Contractor shall provide a two (2) year written guarantee, covering the flashing and sheet metal materials and workmanship. Should any defects occur during the stated period, they shall be corrected immediately, and all damage caused by such defects shall be corrected; all corrective Work shall be at the Contractor's expense.

PART 2 – PRODUCTS

2.1 MATERIALS FOR FLASHING FABRICATION

A. Lead Coated copper Sheet

Cold rolled copper, ASTM B370. Lead coating; ASTM B101, Type 1 weighing 0.06 to 0.07 lbs per sq ft applied to each side.

ASTM B29. Minimum Wgt. 4 lbs per sq ft.

2.2 MANUFACTURED MATERIALS

A. Copper/fabric flashing: consisting of a full sheet of copper, weight of copper core not less than 5 ounces per square foot, permanently bonded with rubber based adhesive to and between 2 layers of fiberglass or polymer fabric. Each layer of fabric shall be 0.3 oz. per sq. ft. minimum weight, with minimum 10x20 threads per inch. Flashing shall be compatible with air barrier system, sealants, adhesives, and other adjacent materials.

1. Manufacturers / Products

a. York Manufacturing, Inc., Sanford, Maine: Multi-Flash 500 Copper Fabric Flashing.
b. Advanced Building Products Inc., Springvale Maine: Copper Sealtite 2000.
c. Sandell Manufacturing Company, Schenectady, NY: Sandell Copper Fabric Flashing NA.

2.3 FASTENERS

A. Nails

"Stronghold" type large flat head roofing nail.

1. For Copper: Hardened copper.

2. For Stainless Steel: Stainless steel.

B. Screws, Bolts, and other Fastening Accessories

1. For Copper: Copper or brass.

2. For Stainless Steel: Stainless steel type 316.

C. Anchors

Provide one of the following types:

1. Hammer driven anchors, consisting of a stainless steel drive pin and a corrosion resistant metal expansion shield inserted thru a stainless steel disc with an EPDM sealing washer.

2. Self-tapping, corrosion resistant, concrete and masonry screw inserted thru a stainless steel disc with an EPDM sealing washer.

D. Fasteners for Through-Wall Flashing Termination Bar

1. Tapcon Concrete Screw: stainless steel.

2.4 MISCELLANEOUS MATERIALS

A. Solder

Composition of block tin/pig lead of proportion recommended by the metal manufacturer, stamped either 50/50 or 60/40 "Warranted".

B. Flux

Paste or acid type as recommended by the metal manufacturer.

C. Bituminous Coating: FS TT-C494.

D. Type 3 Sealant (For concealed sealant joints of thru-wall cap receivers and other areas which require concealed sealant).

One part butyl rubber sealant; Pecora BC-158, PTI 707, or Woodmont chem-Calk 300.

E. Termination Bar (For thru-wall copper/fabric flashing)

Plastic. Provide material compatible with the air barrier system. York Manufacturing Co., Sanford, Maine.

F. Flashing Sealants and Adhesives

Provide products recommended in writing by the flashing manufacturer, and compatible with all adjacent materials, including components of the air barrier system. Materials containing asbestos are prohibited. Mastics and other asphaltic materials shall not be used where sealant is specified or required.

1. Where low modulus silicone sealant is indicated provide ASTM C 920, single-component, neutral-curing silicone; Class 100/50, Grade NS, Use NT, Use O.

2.5 FABRICATION

A. General: Where practicable, form and fabricate sheet metal Work in the factory or shop. Produce bends and profiles accurately to the indicated shapes. Where not indicated or specified, follow the applicable requirements of the reference standards listed in PART 1. All corners to be factory prefabricated. Hem exposed sheet metal to eliminate all sharp edges and corners.

B. Cap Flashing (one-piece): Fabricated to be spring-tight against wall/base flashing. All corners shall be factory prefabricated: mitered and lapped approximately 1” at

corner, and fully soldered or welded. At expansion joints, provide v-notch splice joint with 6” lap each side.

1. Stainless Steel: 18 ga.

2. Cap Flashing: Three way mortar bond type receiver with snap fit cap flashing.

   Acceptable manufacturers / products:

   a. Keystone Flashing Co., 5119 N. Second Street, Philadelphia, PA. "Keystone Two-Piece cap Flashing".
   b. Cheney Flashing Co., 623 Prospect St., Trenton, NJ. "Cheney Prefabricated Snap Lock Cap Flashing".
   c. LITSCO, Long Island Tinsmith Supply Corp., 76-11 88th St., Glendale, NY. Two-piece snap fit cap flashing; with 3-way mortar bond receiver.
   d. B & B Sheet Metal, 25-40 50th Ave. Long Island City, NY. Two-piece snap fit cap flashing; with 3-way mortar bond receiver.

C. Thru-Wall Scupper

1. Stainless Steel: 24 ga. (0.025").

D. Shop-Formed Coping

1. Stainless Steel: 18 ga (0.025").

E. Sealant Edge Flashing

1. Stainless Steel: 26 gauge, hemmed edge.

F. Gutters

1. Materials: 18 ga Stainless Steel.

2. Components

   a. Hung Gutter: 20 oz.
   b. Conductor Heads: 16 oz.
   c. Outlet Tube, offsets and elbows: 16 oz.
   d. Continuous cleats: 20 oz.
   e. Gutter Hanger Brackets: 1" x 3/16" brass or copper bar.
   f. Gutter Braces: 1" x1/8" brass or copper bar.
   g. Gutter Stiffener: 3/4" x 1/8" brass or copper bar.
   h. Downspout Support Hanger: 1"x1/16" brass or copper.
   i. Wire Strainers: 18 gage copper wire, 1/2" mesh.

3. Fabrication

a. Fabricate gutters and fittings to shapes and profiles indicated on Drawings; if details are not indicated, follow applicable requirements of the Architectural Sheet Metal Manual of SMACNA.
b. Form gutters and downspouts in 10'-0" long sections.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Coordinate the work of this Section with other Work for the correct sequencing of items which make up the entire system of weatherproofing or waterproofing.

3.2 PREPARATION

A. Do not install the Work of this Section unless all necessary nailers, blocking and other supporting components have been provided.

B. Do not install the Work of this Section unless all substrates are clean and dry. Do not cover air barrier membrane until the completion of a curing period if recommended by the membrane manufacturer.

3.3 INSTALLATION

A. Isolation

Separate dissimilar metals from each other with a dielectric coating to prevent galvanic action. Coating shall be bituminous or synthetic material as required for compatibility with adjacent materials.

B. Tinning and Soldering

1. Use soldering irons (heavy coppers) as Industry Standard. Torch soldering is not acceptable.

2. Clean, flux and tin all surfaces to be soldered.

3. Sweat solder thoroughly into seams, completely filling the seam for the full width.

4. Upon completion of soldering, remove all traces of flux residue, and if required, apply a neutralizing wash followed by a clean water wash.

C. Installing Cap Flashing

1. General: Form and install the cap to provide a spring tight fit against the base flashing. Lap all end joints a minimum of 6” and base flashing a

minimum of 4". Extend the cap continuously around corners or provide lock seams. Install waterstop flashing at expansion joints.

2. Cap Flashing for Installation in Reglets:

   a. Extend the cap flashing into the reglet, applying pressure to securely lock it into position along its entire length.
   b. Pack the reglet with lead wool to within 1/4" of the reglet opening, then fill with sealant and tool to a slightly concave surface.

3. Surface Mounted Cap Flashing:

   a. Form the top portion of the cap flashing which comes in contact with the wall surface with a 1" wide bearing surface. Form a 45 degree x 1/4" wide stiffener and calking flange along the top edge.
   b. Apply Type 2 sealant on the back side of the bearing surface.
   c. Secure the cap flashing to the wall with fasteners spaced 12" oc thru the bearing surface.
   d. Apply Type 2 sealant along the calking flange.

4. In-Wall Cap Flashing (New Masonry Construction):

   a. Extend the built-in portion of the cap a minimum of 4" into the wall. Form the edge of the built-in portion with a 1/4" hook dam.
   b. Set the cap so there is mortar above and below the built-in portion.
   c. Lap all seams a minimum 6" and apply Type 3 sealant between the mating surfaces of the built-in portion of the flashing.

5. Cap flashing For Installation in Receivers: Insert the cap flashing into the receiver locking slot. Apply upward pressure along the entire length of the cap flashing so that it is securely locked into position. Nail 1" wide strap of same material as flashing at 32" o.c. prior to inserting cap in receiver. After cap installation, bend strap over edge of flashing by 1/2" to prevent flashing from coming out of receiver.

6. Pre-tin and solder with soldering irons (heavy coppers) all inside and outside corners.

7. Where applicable, release existing soldered lap with soldering iron, install base flashing, dress down and re-solder existing lap.

D. Installing Thru Wall Scupper

1. Form the scupper with 4" wide flashing flanges.

2. Where protected membrane roofing is provided, scuppers shall be equipped with grilles with opening size not greater than the size of stone ballast used on the roof.

3. Lock and solder, or rivet and solder all construction joints of the scupper.

4. For single ply Membranes: Apply the membrane manufacturer's recommended sealant between the contact surfaces of the horizontal portion of the splice plate and the gravel stop.

5. Secure the gravel stop at the mid point, and at ends of each 10'-0" section. Allow a 1/2" space between each section for expansion.

6. Provide a 6" long, exposed matching aluminum cover at all joints, fabricated to conform to the shape of the gravel stop.

E. Roof Drain Flashing

Install 30" square lead flashing over the roofing membrane. Turn flashing into drain body.

F. Sealant Edge

Provide stainless steel sealant edge flashing on relieving angles as indicated on the Drawings and wherever else indicated. Form flashing as required to suit lipped brick or other configuration. Adhere to relieving angle with a full coat of low modulus silicone sealant. Seal joints with sealant. Provide factory prefabricated corners and lap pieces a minimum of 4”, with a full coat of low modulus silicone. Edge shall be hemmed.

G. Gutters

1. Connection to Existing Construction where applicable: Tie the items of Work in with the existing work to obtain watertight installation. Match the existing installation as much as practicable, unless otherwise specified. Repair and dress adjacent existing components as required to make secure and neat connections with new items.

2. Installation of Hung Gutters:

a. Install gutter hanger brackets 3'-0" oc. Install the brackets so there will be a slight pitch in the gutter towards the downspouts.
b. Join the gutter sections with 1" wide lapped, riveted, and soldered seams. Use 3/16" diameter rivets spaced 2" o.c.
c. Install expansion joints where indicated on the Drawings. If not indicated, place the expansion joints at mid points between the downspouts at maximum intervals of 48 feet.

1) Form the expansion joints with end baffles conforming to the shape of the gutter. Rivet and solder the baffles to the gutter section.
2) Install a cover plate over the baffle.

d. Install gutter end pieces, mitered corners and outlet tubes. Solder joints and connections.

e. Install a continuous stiffener bar along the top front edge of the gutter. Fold the gutter around the stiffener bar so it is securely locked in place.

f. Install gutter braces 3'-0" oc, staggered from the gutter hanger brackets. Secure the braces to the stiffener bar and to the back vertical portion of the gutter with brass or copper bolts.

g. Secure the top back edge of the gutter to the gravel stop, eave flashing, or continuous cleat as indicated on the Drawings.

END OF SECTION 076000

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SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide all roof accessories as indicated on the Drawings and as specified herein, including, but not limited to, the following:

1. Roof Hatches

1.2 REFERENCES

A. References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

B. Underwriters Laboratories, Inc. (UL).

C. New York City Board of Standards and Appeals (BSA, or New York City Materials Equipment Acceptance (MEA).

D. Occupational Safety and Health Administration (OSHA).

1.3 SUBMITTALS

A. Shop Drawings

Show relationship with adjoining Work and anchorage methods. Include plans, sections, and details.

B. Product Data

Manufacturer's catalog sheets, specifications, and installation instructions for roof hatches and vents.

1. Emergency Electric Release Devices: Electrical rating (volts, amps).

C. Contract Closeout Submittals

Operation and Maintenance Data: Deliver 2 copies, covering the installed products, to the RIOC.

D. Warranties

1.4 QUALITY ASSURANCE

A. Manufacturer

Minimum of five years' experience in the manufacture of products of type specified.

B. Installer

Minimum of three years experience in the installation of products of type specified.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle the products of this Section as recommended by the Manufacturer, to protect from damage.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate installation of roof accessories with roofing and flashing.

1.7 MAINTENANCE

A. Spare Parts

Furnish three spare 160°F fusible links for each roof vent with such device.

1.8 WARRANTIES

A. All roof hatches and vents shall be furnished with the manufacturer's standard 5 year warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Babcock-Davis Hatchways, Inc., Arlington, MA

B. Bilco Co., New Haven, CT

2.2 ROOF HATCHES

A. Type

Aluminum units consisting of an insulated and weather stripped hinged cover on an insulated curb fitted with integral cap flashing and safety railing.

1. Cover: 11 gage, mill finish aluminum with 3" beaded or hemmed flange, 1" thick fiberglass insulation covered by a 18 gage aluminum liner, and neoprene or closed cell rubber gasket seal around perimeter. Cover shall open to 90 degrees.

2. Curb: 11 gage minimum, mill finish aluminum with 3½ " flange at bottom with holes for securing to roof deck, 11 gage aluminum cap flashing at top, and 1" thick rigid fiberboard insulation on exterior of curb.

   a. Curb height shall be as required to provide a dimension of at least 6” from top of roof surfacing (gravel, pavers, etc.) to bottom of integral cap flashing.

3. Fabrication: Continuously weld metal joints.

4. Hardware: Zinc or cadmium plated steel; heavy pintel hinges, enclosed spring operators, positive snap latch with turn handles inside and outside, padlock hasp inside, and automatic hold-open operating arm with one hand grip release handle.

5. Safety railing: Conform to OSHA Standard CFR 29 1910.23 Fall Protection in General Industry, and local regulations. Hatch manufacturer’s railing system, with chain or gate on access side. Rail system shall be supported from hatch assembly without penetrating roofing. Provide weatherproof label: “NO HOISTING”. Provide corrosion resistant materials throughout.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install roof accessories in accordance with the manufacturer's instructions, unless shown otherwise on the Drawings. Securely anchor units in place to the substrate by bolting, screwing or welding.

B. Where mounting flanges are set directly in the roofing, embed the flanges in roofing cement or other waterproof mastic or adhesive as recommended by the manufacturer of the roofing. On sloping surfaces, integrate mounting flanges with roofing elements to properly shed water.

3.2 FIELD QUALITY CONTROL

A. Tests

1. Roof Vents

a. Vents with Electric Release: Reset each roof vent which is equipped with an emergency electric release device immediately after system acceptance test is performed by the contractor providing the fire protective signaling system.

b. Vents with Fusible Link: Test each roof vent for proper operation after installation by fusing the link. Provide a replacement fusible link after approved test.

END OF SECTION 077200

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SECTION 079000 - JOINT SEALERS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide all joint sealer Work as indicated on the Drawings, as required for the completed Work, and as specified herein. This Section includes joint sealants for the following applications:

1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:

   a. Construction joints in cast-in-place concrete.
   b. Joints between metal panels.
   c. Joints between different materials listed above.
   d. Perimeter joints between materials listed above and frames of doors, windows and louvers.
   e. Control and expansion joints in soffits and other overhead surfaces.
   f. Joints in walks, pavements and curbs.
   g. Other joints as indicated.

2. Exterior joints in the following horizontal traffic surfaces:

   a. Control and expansion joints in brick pavers.
   b. Isolation and contraction joints in cast-in-place concrete slabs.
   c. Joints between different materials listed above.
   d. Other joints as indicated.

B. The work of this section shall not take place until all PCB containing caulk has been removed in accordance with section 02082 and paint (as designated by the RIOC) has been removed in accordance with Section 02085 - Exterior Paint Removal.

1.2 REFERENCES

A. References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work

1. American Society for Testing and Materials (ASTM)

1.3 SUBMITTALS

A. Product Data

Catalog sheets, specifications, and installation instructions for each type of joint sealant product specified except miscellaneous materials.

B. Samples for Initial Selection:

1. For general purpose use around windows and at relieving angles, Colors of Exposed Joint Sealants: Match Architect's samples.

2. For all other uses: provide Manufacturer’s color charts consisting of strips of cured sealants showing the full range of Manufacturer’s standard colors available for each product exposed to view.

C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2"wide joints formed between two 6” long strips of material matching the appearance of exposed surfaces adjacent to joint sealants

D. Quality Control Submittals

1. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

2. Installer's Qualifications Data: Affidavit required under Quality Assurance Article.

3. Company Field Advisor Data: Name, business address, and telephone number of Company Field Advisor.

4. Preconstruction Test Results

a. Sealant manufacturer’s test reports certifying compatibility and adhesion with all contiguous materials.
b. Sealant manufacturer’s test reports certifying that the sealant will not stain contiguous materials.
c. The results of field adhesion testing.

E. Mockups

In accordance with Article titled Quality Assurance.

F. Low Emitting Materials Compliance Submittals

1. Provide documentation for each sealant, sealant primer and cleaner to be used on site and within the weatherproofing/waterproof membrane (interior) of the building, indicating that the sealants and primers meet V.O.C. requirements as stated in Specification Section G01600.

1.4 QUALITY ASSURANCE

A. Installer's Qualifications

The persons installing the sealants and their supervisor shall be personally experienced in the installation of sealants and shall have been regularly employed by a company engaged in the installation of sealants for a minimum of two years.

1. Furnish a letter from the sealant manufacturer, stating that the Installer is authorized to install the manufacturer's sealant materials.

B. Container Labels

Include manufacturer's name, trade name of product, kind of material, federal specification number (if applicable), expiration date (if applicable), and packaging date or batch number.

C. Preconstruction field-adhesion testing

Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints as directed by Architect.

2. Conduct field adhesion tests for each kind of sealant and joint substrate.

3. Test using ASTM C1193 Method A: For joints with dissimilar substrates, verify adhesion to each substrate separately

4. Do not use sealants that fail to adhere to joint substrates during testing.

D. Mockups

Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joint sealer materials as recommended by the Manufacturer, to protect from damage.

1.6 PROJECT CONDITIONS

A. Environmental Requirements

1. Temperature: Unless otherwise approved or recommended in writing by the sealant manufacturer, do not install sealants at temperatures below 40°F or above 85°F.

2. Humidity and Moisture: Do not install the Work of this Section under conditions that are detrimental to the application, curing, and performance of the materials.

3. Ventilation: Provide sufficient ventilation wherever sealants, primers, and other similar materials are installed in enclosed spaces. Follow manufacturer's recommendations.

4. Do not proceed with installation of joint sealants under the following conditions

   a. When joint substrates are wet.
   b. Where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
   c. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.
   d. Surfaces are frozen.
   e. Surfaces are superheated by the sun.

B. Protection

1. Protect all surfaces adjacent to sealants with non-staining removable tape or other approved covering to prevent soiling or staining.

2. Protect all other surfaces in the Work area with tarps, plastic sheets, or other approved covering to prevent defacement from droppings.

3. Protect any painted surfaces which are not included in the Work from impact or damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Momentive Performance Materials-GE Silicones, Waterford, NY 12188

B. Dow Corning Corp., Midland, Michigan 48686

C. Pecora Corp., Harleyville, PA

D. Tremco Sealants and waterproofing, Beachwood, OH 44122

E. Bostik, Middleton, MA 01949

F. Sika Corporation, Lyndhurst, NJ 07071

2.2 SEALANTS

A. Type 1 Sealant (for use in vertical expansion joints where movement occurs; for general purpose use around windows, door frames, louvers, and other junctures).

1. One-part low-medium modulus silicone sealant (plus or minus 50% movement); ASTM C920 classifications type S, grade NS, class 25, uses NT, M, G, and A: General Electric Silpruf SCS2000, Dow Corning 791, Pecora 864NST, Tremco Spectrem 2 or Sika SikaSil WS 295.

   Silicones shall meet the following requirements:

   - ASTM C719 - Low-Medium Modulus (+ or - 50%). Sealants shall not exhibit any cracking or surface degradation after 5000 hours exposure in the Atlas Twin Arc Weatherometer.
   - ASTM C661 - Shall not incur a durometer increase greater than 10 points.
   - Sealants shall contain zero parts of toxic isocyanurate ingredients.

B. Sealant for use for pavements, walks, and curbs

1. For Horizontal Joints: Two-part, self-leveling polyurethane sealant for traffic bearing construction; ASTM C920 classifications type M, grade P, class 25, uses T, M, A, and O (granite): Pecora Urexpan NR-200, or , Tremco THC 900/901 or Sika Sikaflex 2C SL.

2. For Vertical Joints: Two-part, non-sag polyurethane sealant; ASTM C920 classifications type M, grade NS, class 25, uses NT, M, A and O (granite): Pecora Dynatrol II, or Bostik Chem-Calk 505, Tremco Dymeric 240FC or Sika Sikaflex 2C NS.

C. Sealant for general use around windows, store front systems, door frames, metal panel systems, metal coping, louvers, cast stone copings and other junctures where movement occurs.

One-part ultra-low modulus neutral cure silicone sealant; ASTM C920 classifications type S, grade NS, class 25, uses NT, M, G, A and O: Pecora 890 FTS; Tremco Spectrem-1 or Dow Corning 790 or Sika SikaSil WS 290.

Provide custom colors for use around window perimeters, to match window frame or masonry, or other colors as determined by the Architect.

J. Pre-formed Sealant for exterior applications

1. Low modulus silicone sealants: Pecora Sil-Span, Sealex ImmerSeal, GE Ultraspan US1100.

2. Acrylic impregnated flexible polyurethane foam, such as Sealtite Standard by Schul International Co., Tremco Illmod 600 or Compriband.

2.3 JOINT FILLERS

A. Elastomeric Tubing Sealant Backings: (for precast panel joints not compatible with Silicone Sealants): Neoprene, butyl or EPDM tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26ºF (minus 32ºC). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

ASTM D1056, Class SC (oil resistant and medium swell), 2 to 5 psi compression deflection.

B. Expanded Polyethylene Joint Filler (for existing joints)

Flexible, compressible, closed-cell polyethylene of not less than 10 psi compression deflection (25 percent).

C. Closed-Cell Polyurethane or Closed-Cell Expanded polyethylene Joint Filler (for all cast-in-place concrete work).

Resilient, compressible, semi-rigid; W.R. Meadow Ceramar or equal.

D. ASTM D1056, Class RE41 (for masonry joints) where shown on the Drawings.

E. Filler Sealant (for Parapet Expansion Joints)

Acrylic impregnated compressible polyurethane foam precompressed to 50% of its uncompressed length: "Sealtite B" by Schul International or “Backerseal” by Emseal.

2.4 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

D. Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

1. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), Type O (open-cell material) or Type B (bicellular

material with a surface skin), as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

E. Bond Breaker Tape

Polyethylene or other plastic tape as recommended by the sealant manufacturer; non-bonding to sealant; self-adhesive where applicable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine all joint surfaces for conditions that may be detrimental to the performance of the completed Work. Do not proceed until satisfactory corrections have been made.

3.2 PREPARATION

A. Clean joint surfaces immediately before installation of sealant and other materials specified in this Section.

1. Remove all loose materials, dirt, dust, rust, oils and other foreign matter that will impair the performance of materials installed under this Section.

2. Remove lacquers, protective coatings and similar materials from joint faces with manufacturer's recommended solvents.

3. Thoroughly clean surfaces on which sealant is to be applied using methods such as grinding, acid etching or other approved and manufacturer's recommended means, if required, to clean the joint surfaces, assuring that the sealant materials will obtain positive and permanent adhesion.

4. Prime surfaces, if required, as recommended by Manufacturer before applying sealant.

B. For Pavements, Walks, and Curbs

1. Set joint fillers at proper depth and position as required for installation of bond breakers, backer rods, and sealants. Do not leave voids or gaps between the ends of joint filler units.

a. Smooth Edged Joints: For joints between two concrete slabs or where new concrete abuts smooth-edged materials, use either cork joint filler or closed cell polyurethane joint filler.

b. Irregular Edged Joints: For joints where new concrete abuts granite curbs or other irregular edges, use closed cell polyurethane joint filler.

c. Priming Joint Surfaces:

1) Prime joints which are to receive Sealants.
2) For joints of friable (crumbly, chalky) masonry surfaces and other surfaces which are to receive Sealant, prime as recommended by Manufacturer.
3) Prime joints other than those above if so recommended by the manufacturer's printed instructions.
4) Do not allow the primer/sealer to spill or migrate onto adjoining surfaces.

3.3 JOINT BACKING INSTALLATION

A. Install bond breaker tape in relaxed condition as it comes off the roll. Do not stretch the tape. Lap individual lengths.

B. Install backer rod of sufficient size to fill the joint width at all points in a compressed state. Compress backer rod at the widest part of the joint by a minimum of 25 percent. Do not cut or puncture the surface skin of the rod.

3.4 SEALANT INSTALLATION

A. Except as shown or specified otherwise, install sealants in accordance with the manufacturer's printed instructions.

B. Install sealants with ratchet hand gun or other approved mechanical gun. Where gun application is impracticable, install sealant by knife or by pouring, as applicable.

C. Finishing

Tool all vertical, non-sag sealants so as to compress the sealant, eliminating all air voids and providing a neat smoothly finished joint. Provide slightly concave joint surface, unless otherwise indicated or recommended by the manufacturer.

1. Use tool wetting agents as recommended by the sealant manufacturer.

3.5 FIELD QUALITY CONTROL

A. Field Adhesion Testing of Sealants - Test completed elastomeric joints as follows:

1. Extent of Testing: Test completed elastomeric sealant joints as follows:

a. Perform 10 tests for the first 1000 feet of joint length for each type of elastomeric sealant and join substrate.

b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.

2. Test Method – Test joints by hand pull method described below:

a. Make knife cuts from one side of the joint to the other, followed by two cuts approximately 2 inches long at sides of joint and meeting cross cut at one end. Place a mark 1 inch from cross-cut end of 2 inch piece.
b. Use fingers to grasp 2 inch piece of sealant between cross-cut end and 1” mark, pull firmly at a 90 degree angle or more in direction of side cuts while holding a ruler along sides of sealant. Pull sealant out of joint to the distance recommended by the sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension, hold this position for 10 seconds.
c. For joints with dissimilar substrates, check adhesion to each substrate separately. Do this by extending cut along one side, checking adhesion to opposite side.

3 Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.

4. Inspect tested joints and report on the following:

a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
b. Whether sealants filled joint cavities and are free of voids.
c. Whether sealant dimensions and configurations comply with specified requirements.

5. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.

6. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

7. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.6 CLEANING

A. Immediately remove misapplied sealant and droppings from metal surfaces with solvents and wiping cloths. On other materials, remove misapplied sealant and droppings by methods and materials recommended in writing by the manufacturer of the sealant material.

B. After sealants are applied and before skin begins to form on sealant, remove all masking and other protection and clean up remaining defacement caused by the Work.

END OF SECTION 079000

SECTION 079500 - EXPANSION JOINTS SYSTEMS

PART 1 – GENERAL

1.01 Work Included

A. The work shall consist of furnishing and installing waterproof expansion joints in accordance with the details shown on the plans and the requirements of the specifications. Preformed sealant shall be silicone pre-coated, preformed, pre-compressed, self-expanding, sealant system.

B. Related Work
- Division 3 - Cast-in-Place Concrete
- Division 7 - Thermal & Moisture Protection
- Division 7 - Sealants, Caulking and Waterproofing

1.02 Submittals

A. General – Submit the following according to Division 1 Specification Section.

B. Standard Submittal Package – Submit typical expansion joint drawing(s) indicating pertinent dimensions, general construction, expansion joint opening dimensions and product information.

C. Sample of material is required at time of submittal.

D. All products must be certified by independent laboratory test report to be free in composition of any waxes or wax compounds using FTIR and DSC testing.

E. All products shall be certified in writing to be: a) capable of withstanding 150°F (65°C) for 3 hours while compressed down to the minimum of movement capability dimension of the basis of design product (-25% of nominal material size) without evidence of any bleeding of impregnation medium from the material; and b) that the same material after the heat stability test and after first being cooled to room temperature will subsequently self-expand to the maximum of movement capability dimension of the basis-of-design product (+30% of nominal material size) within 24 hours at room temperature 68°F (20°C).

1.03 Product Delivery, Storage and Handling

A. Deliver products to site in Manufacturer's original, intact, labeled containers. Handle and protect as necessary to prevent damage or deterioration during shipment, handling and storage. Store in accordance with manufacturer's installation instructions.

1.04 Basis of Design

A. All joints shall be supplied by Nystrom Building Products, 9300 73rd Avenue North, Brooklyn Park, MN 55428 USA.

B. Alternate manufacturers and their products will be considered, provided they meet the design concept and are produced of materials that are equal to or superior to those called for in the base product specification.

C. Any proposed alternate systems must be submitted and receive approval 3 weeks prior to the bid. All post bid submittals will not be considered. This submission shall be in accordance with material and substitutions.

1.05 Quality Assurance

A. The General Contractor will conduct a pre-construction meeting with all parties and trades involved in the treatment of work at and around expansion joints including, but not limited to, concrete, mechanical, electrical, HVAC, landscaping, masonry, curtain wall, waterproofing, fire-stopping, caulking, flooring and other finish trade subcontractors. All superintendents and foremen with responsibility for oversight and setting of the joint gap must attend this meeting. The General Contractor is responsible to coordinate and schedule all trades and ensure that all subcontractors understand their responsibilities in relation to expansion joints and that their work cannot impede anticipated structural movement at the expansion joints, or compromise the achievement of watertighness or life safety at expansion joints in any way.

B. Warranty – Manufacturer's standard warranty shall apply.

C. LEED Building Performance Requirements: The VOC of the silicone must not exceed 50 grams/liter.

PART 2 – PRODUCT

2.01 General

A. Provide traffic durable, watertight, expansion joint by Nystrom for expansion joints and isolation joints in decks. Typical locations include, but are not limited to the following: applications for joints over occupied space, below-grade, stair tower perimeters, elevator perimeters, stadium tread and risers, parking deck joints, treatment plant perimeters and covers, ice-floor perimeter joints, and structural expansion joints. System shall perform waterproofing, traffic bearing and movement-accommodation functions as the result of a single installation and without the addition of gutters, vapor barriers, bladders, or other devices suspended beneath or within the system in any way.

B. Sealant system shall be comprised of three components: 1) cellular polyurethane foam impregnated with hydrophobic 100% acrylic, water-based emulsion, factory coated with highway-grade, fuel resistant silicone; 2) field-applied epoxy adhesive primer, 3) field-injected silicone sealant bands.

C. Material shall be capable as of movements of +30%, -25% (55% total) of nominal material size. Standard sizes from 1/2” (12mm) to 4” (150mm). Depth of seal as recommended by manufacturer.

D. Silicone coating to be highway-grade, low-modulus, jet-fuel resistant silicone applied to the impregnated foam sealant at a width greater than maximum allowable joint extension and which when cured and compressed will form a bellows.

E. PDM to be installed into manufacturer’s standard field-applied epoxy adhesive.

F. PDM is to be installed slightly recessed from the surface such that when the field-applied injection band of silicone is installed between the substrates and the foam-and-silicone-bellows, the system will be essentially flush with the substrate surface.

G. Select the sealant system model appropriate to the movement and design requirements at each joint location that meet the project specification or as defined by the structural engineer of record.

H. Manufacturer’s Checklist must be completed by expansion joint subcontractor and returned to manufacturer at time of ordering material.

2.02 Fabrication

A. PDM System must be supplied precompressed to less than the joint size, packaged in shrink-wrapped lengths (sticks).

B. Directional changes and terminations into horizontal plane surfaces to be provided by factory-manufactured universal-90-degree single units containing minimum 12-inch long leg and 6-inch long leg or custom leg on each side of the direction change or through field fabrication in strict accordance with installation instructions.

PART 3 – EXECUTION

3.01 Installation

A. Preparation of the Work Area

1. The contractor shall provide properly formed and prepared expansion joint openings constructed to the exact dimensions and elevations shown on manufacturer's standard system drawings or as shown on the contract drawings. Deviations from these dimensions will not be allowed without the written consent of the engineer of record.

2. The contractor shall clean the joint opening of all contaminants immediately prior to installation of expansion joint system. Repair spalled, irregular or unsound joint surfaces using accepted industry practices for repair of the substrates in question. Remove protruding roughness to ensure joint sides are smooth. Ensure that there is sufficient depth to receive the full depth of the size of the DSM being installed. Refer to Manufacturers Installation Guide for detailed step-by-step instructions.

3. No drilling, or screwing, or fasteners of any type are permitted to anchor the sealant system into the substrate.

4. System to be installed by qualified sub-contractors only according to detailed published installation procedures and/or in accordance with job-specific installation instructions of manufacturer's field technician.

3.02 Clean and Protect

A. Protect the system and its components during construction. Subsequent damage to the expansion joint system will be repaired at the general contractor's expense. After work is complete, clean exposed surfaces with a suitable cleaner that will not harm or attack the finish.

END OF SECTION

SECTION 081100 - STAINLESS STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide stainless steel doors and frames as indicated on Drawings and specified herein.

B. The following Sections contain requirements that relate to this Section:

Thresholds, Weatherstripping and Seals...Section 087300

1.2 REFERENCES

A. References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

1. Underwriters' Laboratories, Inc. (UL)

2. American Society for Testing and Materials (ASTM)

3. National Fire Protection Association (NFPA)

4. Steel Door Institute (SDI)

5. NAAMM HMMA 866 - Guide Specifications for Stainless Steel Doors and Frames.

1.3 SUBMITTALS

A. Product Data

Manufacturer's catalog sheets, specifications, and installation instructions.

B. Shop Drawings:

1. Show details of each frame type, elevation and construction for each door type, conditions at openings, location for each door type, location and installation requirements for finish hardware (including cutouts and reinforcements), details of connections, and anchorage and accessory items.

2. Include a schedule of doors and frames using the same reference numbers for details and openings as those on the Contract Drawings.

C. Samples

1. Door: 12-inch square corner section with hinge preparation, and top and internal construction.

2. Door Frames: 12-inch by 12-inch corner section with hinge reinforcement and plaster guard.

3. Finishes and patterns: 10-inch square sheets of each finish and pattern.

D. Quality Control Submittals

1. Include approval data and acceptance by a New York City Building Department approved testing agency for all fire-rated assemblies.

2. Provide certification glazing meets safety impact requirements of CPSC 16 CFR 1201.

3. Provide certification for oversized assemblies as described in Quality Assurance.

4. Thermal certification: Letter from manufacturer certifying that exterior opaque doors are insulated to achieve a "U" Factor no greater than 0.60 when tested in accordance with ASTM C1363.

5. Air infiltration rate report: Manufacturer's statement that the opaque door when subjected to air infiltration test in accordance with NFRC 400, the air infiltration did not exceed 0.20 cubic feet per minute per square foot of door.

6. Submit manufacturer's recommended cleaning and maintenance instructions.

E. Warranties

Provide manufacturer/installer warranty.

1.4 QUALITY ASSURANCE

A. Provide doors and frames complying with ANSI/SDI A250.8 and as herein specified.

B. Fire Rated Assemblies

Wherever fire resistance classification is shown or scheduled for steel doors and frames, provide fire rated units that have been tested as fire door assemblies and comply with National Fire Protection Association (NFPA) Standard No. 80, are tested in accordance with NFPA 252 or UL 10B/UL 10C and UL 1784 as required by the NYC Building Code and comply with these Specifications. Identify each door and frame with metal UL, or Warnock Hersey labels indicating applicable fire class of the unit. Rivet or weld labels on the hinge edge of door and jamb rabbet of frame.

C. Regulatory Requirements

Not withstanding the requirements for fire-rated assemblies noted above, all fire-rated doors and frames shall be approved for use in New York City.

Provide evidence of acceptance by an approved testing agency. Provide permanent labels on doors and frames as required by the New York City Building Code. Labels shall be applied at the factory or where fabrication and assembly are performed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store doors and frames on raised platforms in vertical position with blocking between units to allow air circulation.

B. During delivery, storage and handling, protect doors and frames from water damage.

C. Provide delivery, storage and handling in such manner to prevent damage to products.

1.6 FIELD EXAMINATION

A. At the Site, before door installation, the RIOC reserves the right to select at random one or more doors for examination by cutting a portion of such size to reveal the construction of the particular door.

1. If the examination finds that the doors examined do not comply with requirements of the Specifications, all doors shall be removed from the Site and new doors shall be provided. Costs of examination and replacement of rejected doors shall be borne by Contractor.

2. If the examination finds that the doors do comply with the requirements of the Specifications, the cost of the examination and the cost of the replacement of the examined doors will be borne by the RIOC.

1.7 GAGE STANDARDS

A. Gages specified are based on U.S Standard Gauge for hot rolled and cold rolled steel sheets.

B. The allowable tolerances for steel sheet thicknesses shall be in accordance with HMMA Standards.

1.8 WARRANTY

A. Submit warranty signed by manufacturer and installer, agreeing to replace assemblies which fail in materials, performance or workmanship within the specified warranty period.

1. Warranty Period: 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide Stainless Steel Doors And Frames fabricated by Next Door Company; 1840 N. Commerce Parkway, Suite 1, Weston, Florida 33326; Telephone (954)772-6666, Fax (954)772-8466.
Or Approved Equal

B. Provide both doors and frames from a single manufacturer who has specialized (dedicated facility, tooling, equipment, etc.) in the manufacture of commercial stainless steel entry doors and frames for not less than 5 years.

C. Provide Doors and Frames from a single manufacturer who has a dedicated facility for the assembly, welding, and polishing of stainless steel. The manufacturer should have dedicated tooling, fixtures, and machine tools, for the manufacture of stainless steel products. Dedicated is defined as exclusively used for the use on stainless steel materials. This is to avoid contamination with other metals, especially carbon steel.

2.2 MATERIALS

A. Stainless Steel: ASTM A 167, commercial quality type #316 stainless steel.

C. Stainless Steel Sheets

1. Door construction meets the requirements of ANSI A250.8-2003 (SDI 100).

2. Hardware preparations and reinforcements are in accordance with ANSI A250.6-2003.

3. Locations are in accordance with ANSI/DHI A115; alternate locations are available.

D. Anchors and Supports

Fabricate of gages indicated on and of not less than 14 gage sheet steel, unless otherwise indicated, on the drawings

E. Anchorage Devices, Bolts, and other Fasteners

Manufacturer's standard units unless otherwise indicated on the Drawings.

2.3 FABRICATION

A. General:

1. Door shall be integrally manufactured using face sheets of prime stainless steel. No cladding or substrate will be allowed.

2. All internal components, reinforcements and anchors shall be fabricated from stainless steel.

3. Fabricate in compliance with referenced standards, except where exceeded by the requirements of this Specification.

B. Door Construction, General: Comply with ANSI A250.8 - 2003. (SDI 100)

C. Door Construction, General: Comply with NAAMM HMMA 866.

D. Construction: seamless, fully and continuously welded edges, ground smooth, and re-polished to required finish. No visible edge seam is allowed.

E. Thickness: 1-3/4 inches unless otherwise indicated.

F. Door Edge Construction:

1. Seamless; fully and continuously welded except at hardware cutouts; refinished and polished to match face surface. No exposed joints or seams.

2. Lock Seam; visible vertical edge seam on hinge and lock edges, except where hardware cut-out exist.

G. Door and Frame Construction:

1. Door Gauge: 14 gauge (0.067” minimum).

2. All corners, joints, and intersections to be fully and continuously welded. Trim face welds to be ground smooth, and re-polished to achieve specified finish. Miter or butt stops.

3. Frame Gauge: 12 gauge (0.093" minimum).

4. Floor Anchors: one per jamb, minimum 14-gauge angle with two 3/16-inch diameter holes in floor clip for bolting to floor; secured to back of frame. Weld or burn marks on the exposed faces will not be acceptable.

5. Jamb Anchors: Zee-shaped clip, minimum 16 gauge, secured to back of frame.

H. Door and Frame Reinforcements for Builder' s Hardware:

1. Hinge reinforcements: 1-1/4 inch x. 10 inches long x 3/16-inch thick, stainless steel.

2. Strike reinforcements: 14 gauge stainless steel.

3. Closer reinforcements: 14 gauge stainless steel.

4. Surface hardware reinforcements: 14 gauge stainless steel.

5. Dust covers: At frame hinge preps, 1⁄4 inch thick closed cell polyurethane foam with acrylic self-adhesive backing or minimum 22 gauge stainless steel; minimum 22 gauge stainless steel provided behind

2.4 FINISHES

A. Door Finish: NAAMM #8 mirror (polished) finish.

B. Frames Finish: NAAMM #8 mirror (polished) finish.

C. Weldments: Exposed spot welds or other weld marks on exposed surfaces are not acceptable. Grind exposed welds smooth, and re-polish to match specified and surrounding finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions

Examine substrate and conditions, under which the frames are to be installed, for defects which will adversely affect the execution and quality of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install steel doors, frames, and accessories in accordance with the Drawing Details, approved Shop Drawings, and the manufacturer's printed instructions, except as otherwise indicated.

B. Frame Installations

Place frames accurately in position; plumb, align, and brace securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreader bars, leaving surfaces smooth and undamaged.

1. At in-place concrete and in-place masonry construction, place frames and secure in place with anchorage devices. Set anchorage devices opposite each anchor location, in accordance with details on approved Shop Drawings and anchorage device manufacturer's instructions. Leave drilled holes rough, not reamed, and free from dust and debris.

   a. Anchor frames as detailed on the Drawings.

2. Place fire rated frames in accordance with NFPA Standard No. 80.

3. Provide necessary field splices in frames as detailed on approved Shop Drawings, welded and finished to match factory fabrication.

4. Extend jambs to structural floor slab and securely anchor in place.

C. Door Installation

1. Install doors accurately in their respective frames within the clearance specified in Part 2.

2. Place fire rated doors with clearances as specified in NFPA standard No. 80.

D. Drill and tap doors and frames to receive surface applied hardware.

3.3 ADJUSTING

A. Prime Coat Touch-up

Immediately after installation, sand smooth and clean rusted and damaged areas of shop prime coat and apply touch-up of original primer.

B. Final Adjustments

Check and adjust operating finish hardware items prior to final inspection. Leave work in complete and proper operating condition.

3.4 CLEANING

A. Clean doors, frames, and accessories, leaving free of dirt and other foreign material after completion of installation.

END OF SECTION 081100

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SECTION 083300 - COILING DOORS, GRILLES AND SHUTTERS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide rolling doors as indicated on the Drawings and as specified herein.

1.2 REFERENCES

A. References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

1. Aluminum Association (AA)

2. American Society for Testing and Materials (ASTM)

1.3 SUBMITTALS

A. Product Data

1. Catalog sheets, specifications, finishes, operators, and installation instructions for rolling door and grille assemblies.

2. Sensor Edge Data

B. Shop Drawings

1. Submit complete details showing specific project conditions. Show all adjacent materials, dimensions and construction.

2. Wiring and power information for electric motor

C. Quality Control Submittals

1. Submit certification and listing by an Approved Agency in accordance with NYC Dept. of Buildings rules, indicating that the materials and assemblies as regulated by the NYC Building Code are acceptable for the intended use. When test methods are stipulated in the NYC Building Code, the tests utilized shall be stated in the certification. Prior MEA and BSA approvals are acceptable for materials conforming to current Code requirements. Fire rated counter shutters are regulated assemblies.

2. Thermal certification: Letter from manufacturer certifying that exterior rolling doors are insulated with R = min 4.75 or achieve a "U" Factor no greater than 0.5.

3. Air infiltration rate report: Manufacturer's statement that the door when subjected to air infiltration test in accordance with NFRC 400, the air infiltration did not exceed 0.40 cubic feet per minute per square foot of rolling door.

D. Maintenance Data

Deliver 2 copies of the following, covering the installed products, to the RIOC:

1. Operation and maintenance data.

2. Replacement parts list.

E. Warranties in accordance with Article 1.07.

1.4 QUALITY ASSURANCE

A. Manufacturer

Minimum of five years successful experience in the manufacture of products of type specified.

B. Installer

Minimum of three years successful experience in the installation of products of type specified.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle the products of this Section as recommended by the Manufacturer, to protect from damage.

1.6 WARRANTIES

A. All coiling doors, grilles and shutters shall be furnished with a 5 year warranty against all defects in operation and finish.

PART 2 - PRODUCT

2.1 ACCEPTABLE MANUFACTURERS

A. Roll-up Shutters

1. Wayne Dalton, Mt Hope, OH.

2. The Cookson Company, Phoenix, AZ.

3. McKeon Door Co., Bellport, NY

4. Cornell Iron Works, Inc., Mountaintop, PA.

2.2 ROLLING ALUMINUM SHUTTERS

A. Construction

1. Curtain: Interlocking 1½"- 3" flat slats of 16 B&S gage aluminum, with bottom bar complete with slide bolts and lift handle. For exterior application, curtain to be designed to withstand 20 PSF wind load.

2. Frame: Stainless steel, Type 304.

a. Jambs and Head: 16 gage.
b. Sill: 14 gage. Form jamb, head and sill as detailed on the Drawings.

3. Guides: Stainless steel, Type 304, 12 gage.

4. Hood: Stainless steel, Type 304, 24 gage.

5. Counterbalance: steel barrel drum with internal torsion spring and adjusting torsion wheel mounted outside end bracket.

6. Stainless Steel Finish: #4

7. Aluminum Finish: AA204-R1 anodized.

8. Insulated flat slats with R value of min 4.75 for exterior doors required to meet NYC Energy Code.

2.3 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Rolling Grille or aluminum shutter (for interior application): AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.4 mils minimum) complying with AAMA 611.

C. Rolling aluminum shutter (for exterior application): AA-M12C22A13 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: general, hard wear and abrasion resistant coating) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions

Examine door or grille openings for defects that will adversely affect the execution and quality of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install the Work of this Section in accordance with the manufacturer's printed instructions, except as shown or specified otherwise.

1. Field connections and fastening shall be as recommended by the door or grille manufacturer for the conditions, unless otherwise indicated.

2. Install bracing and supports as necessary to rigidly secure door operating equipment and appurtenances.

3. Connect motor operated devices, sensor edge and fire-rated assemblies to the building electrical and fire alarm systems as indicated. Connection of automatic operating devices under Electrical Section 16720.

3.3 FIELD QUALITY CONTROL

A. Tests

Test all functions and features of each rolling door or grille.

3.4 ADJUSTING

A. Adjust and lubricate doors, grilles and operating equipment to operate smoothly.

3.5 CLEANING

A. Clean doors, grilles and clean work area surfaces that have been soiled during performance of the Work.

END OF SECTION 083300

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SECTION 087100 - FINISH HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide finish hardware as indicated on Drawings, as specified herein and as needed for complete hardware requirements.

1.2 REFERENCES

A. References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

1. Federal Specifications (FS).
2. American National Standards Institute (ANSI).
3. National Fire Protection Association (NFPA).
4. Door and Hardware Institute (DHI).
5. Underwriters Laboratories (UL).

1.3 SUBMITTALS

A. Manufacturer's Technical Product Data: Submit for each hardware item type, including cuts, specifications and characteristics, instructions for installation, operation, and maintenance.

B. Samples: Prior to submittal of the final hardware schedule and prior to delivery of hardware, submit one (1) sample of each typical exposed classroom lockset unit. The sample will be reviewed by the ARCHITECT for design, color and texture only. Compliance with other requirements is the exclusive responsibility of the Contractor. Samples approved by the Architect shall be turned over to the GCU for attic stock.

C. Hardware Schedule

NOTE: Provide Schedule for entire Project in one submittal, unless otherwise directed. Submit Hardware Schedule in book form (8-1/2" x 11" pages), indicating the following for each item. No continuous computer printout permitted.

1. Locations of hardware, with cross-reference to schedules and other indications on Drawings.

2. Name, manufacturer, type, style, size, function, and finish.
3. Information for fastenings.
4. Mounting Locations.
5. Materials and sizes of doors and frames.
6. Explanation of abbreviations and symbols.

At time of submittal of Hardware Schedule, furnish hardware templates to fabricators of other factory-prepared work necessary for installation of hardware.

D. Templates

E. Key Schedule

1. Consult with the GCU prior to preparing a keying schedule in order to confirm the required keying scheme.
2. Submit Hardware Key Schedule, prepared by hardware supplier, to the GCU within forty-five (45) days after starting date of Contract.
3. Stamp top face of each key with letter and number starting with A1 to Z1 and continuing the series of letters and numbers to the maximum number of keys furnished. Tag each series of keys.
4. Stamp face of each cylinder with the same corresponding letters and numbers.
5. Locks shall be made up on combinations as specified.
   Furnish schedule of keys in quadruple indicating letter and number of each key and number of rooms, cases, lockers, and other locations for which the keys are intended. Submit schedule for approval before making keys.

F. Deliver to the GCU the required number of keys for each lock, properly marked

G. Key Cabinet Schedules

H. Key Machine, Key Blanks and Attic Stock

Furnish the following in accordance with Article 4.02E:

1. Automatic key cutting machine.
2. 300 of each manufacturer's cylinder key blanks.
3. 10% attic stock of manufacturer's cylinders with keys.

J. Furnish Screw hooks for Tools per Article 2.06I.

K. Warranties

Furnish Warranties as specified in Article 1.08

1.4 QUALITY ASSURANCE

A. Hardware Supplier

Finish hardware shall be furnished by those having a minimum 5 years of builders hardware experience and shall have in their employ at least one certified Architectural Hardware Consultants (AHC) to correctly interpret the plans, detailed drawings and specifications.

B. Manufacturer

Obtain each hardware type from a single manufacturer.

C. Minimum Quality Requirements

The manufacturer shall certify that the Hardware items to be furnished shall be of quality specified herein, and meet the requirements of the applicable ANSI A156 Grade 1 standard for each item.

D. Fire-rated Openings

Provide hardware in compliance with NFPA Standard No. 80 and NYC Building Code requirements, tested and listed by UL for types and sizes of doors, and in compliance with requirements of door frame and door labels.

1.5 SHIPPING, STORAGE, AND HANDLING

A. Package and ship hardware to prevent damage. Properly identify and tag each item. Sort, package and mark hardware with set numbers.

B. Inventory hardware immediately upon delivery.

C. Provide secure (locked) storage area for hardware until installed.

1.6 PROJECT CONDITIONS

A. Coordinate hardware with other work. Tag each item or package separately, with identification related to the final hardware schedule and include basic installation instructions in the package. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated and as necessary for proper installation and functions. Deliver packaged hardware items to the proper locations for installation.

B. Furnish hardware templates to each fabricator of doors, frames and other work to be factory prepared for the installation of hardware.

1.7 CONSTRUCTION KEYING

A. All new buildings or phased modernization projects must utilize a Construction Master Key System. This system is to insure the integrity of the keys and the security of the building. This system must be utilized throughout the construction period. Such key system shall be voided by use of a special “Knock–out” key upon acceptance of Project by the GCU.

1.8 WARRANTIES

A. The hardware manufacturers shall provide full replacement warranty as listed below. Replacement warranty shall include material and labor cost.

-Exit Devices	3 years.
-Locksets, etc.	1 year.
-Hinges	5 years.
-Balance of hardware	1 year.

B. Closers shall be warranted to properly operate door, free from mechanical defects for ten years from date of substantial completion of the Work. Closers which fail to meet specified requirements shall be replaced or repaired and made to operate properly by Contractor without additional expense to the Owner.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule (Source manufacturer listed in boldface).

Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.

Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in S01010, Substitution Procedures. Approval of requests is at the discretion of the architect, GCU, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.

Quantity: Provide the following hinge quantity, unless otherwise indicated:
- Two Hinges: For doors with heights up to 60 inches.
- Three Hinges: For doors with heights 61 to 90 inches.
- Four Hinges: For doors with heights 91 to 120 inches.
- For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
- Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
- Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
- Exterior Doors: Heavy weight, non-ferrous, ball bearing hinges unless Hardware Sets indicate standard weight.
- Interior Doors: Standard weight, steel, ball bearing hinges unless Hardware Sets indicate heavy weight.

Hinge Options: Comply with the following where indicated in the Hardware Sets or on Drawings:
- Non-removable 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 the following applications:
  - Out-swinging exterior doors.
  - Out-swinging access controlled doors.

Acceptable Manufacturers:
- Hager Companies (HA).
- McKinney Products (MK).
- Stanley Hardware (ST).

2.3 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.

Cylinders: Original manufacturer cylinders complying with the following:

Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
Bored-Lock Type: Cylinders with tailpieces to suit locks.
Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.

Keying System: Each type of lock and cylinders to be factory keyed. Conduct specified "Keying Conference" to define and document keying system instructions and requirements. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by GCU. Incorporate decisions made in keying conference, and as follows:
Master Key System: Cylinders are operated by a change key and a master key.
Grand Master Key System: Cylinders are operated by a change key, a master key, and a grand master key.
Great-Grand Master Key System: Cylinders are operated by a change key, a master key, a grand master key, and a great-grand master key.
Existing System: Master key or grand master key locks to GCU's existing system.
Keyed Alike: Key all cylinders to same change key.

Key Quantity: Provide the following keys:

Top Master Key: One (1)
Change Keys per Cylinder: Two (2)
Master Keys (per Master Key Group): Two (2)
Grand Master Keys (per Grand Master Key Group): Two (2)
Construction Control Keys (where required): Two (2)
Permanent Control Keys (where required): Two (2)

Construction Keying: Provide construction master keyed cylinders or temporary keyed construction cores where specified. Provide construction master keys in quantity as required by project Contractor. Replace construction cores with permanent cores. Furnish permanent cores for installation as directed under specified "Keying Conference".

Key Registration List: Provide keying transcript list to GCU's representative in the proper format for importing into key control software.

Key Control Software: Provide one network version of "Key Wizard" branded key management software package that includes one year of technical support and upgrades to software at no charge.

Acceptable Manufacturers:

Corbin Russwin (CR)

2.4 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.

Standards: Closers to comply with UL-10C and UBC 7-2 for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1 provisions for door opening force and delayed action closing.

Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

Where closers are indicated to have mechanical dead-stop, provide heavy duty arms and brackets with an integral positive stop.

Where closers are indicated to have mechanical hold open, provide heavy duty units with an additional built-in mechanical holder assembly designed to hold open against normal wind and traffic conditions. Holder to be manually selectable to on-off position.

Where closers are indicated to have a cushion-type stop, provide heavy duty arms and brackets with spring stop mechanism to cushion door when opened to maximum degree.

Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates, and through-bolt or security type fasteners as specified in the door Hardware Sets.

Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units and high impact, non-corrosive plastic covers standard.

Acceptable Manufacturers:

Corbin Russwin Hardware (RU) - DC8000 Series.
Sargent Manufacturing (SA) - 351 Series.
Norton Door Controls (NO) - 7500 Series.
Yale Commercial Hardware (YA) - 4400 Series.
Rixson (RX)

2.5 ARCHITECTURAL TRIM

A. Door Protective Trim

General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

Metal Protection Plates: ANSI/BHMA A156.6 certified metal protection plates (kick, armor, or mop), beveled on four edges (B4E), fabricated from the following.

Stainless Steel: 050-inch thick, with countersunk screw holes (CSK).

Brass or Bronze: 050-inch thick, with countersunk screw holes (CSK).

Laminate Plastic or Acrylic: 1/8-inch thick, with countersunk screw holes (CSK).

Fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets.

Metal Door Edging: Door protection edging fabricated from a minimum .050-inch thick metal sheet, formed into an angle or "U" cap shapes, surface or mortised mounted onto edge of door. Provide appropriate leg overlap to account for protection plates as required. Height to be as specified in the Hardware Sets.

Acceptable Manufacturers:

McKinney Architectural Hardware (MK).

Rockwood Manufacturing (RO).

2.6 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

Acceptable Manufacturers:

McKinney Architectural Hardware (MK).

Rockwood Manufacturing (RO).

Glynn-Johnson (GJ)

2.7 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

Provide smoke labeled perimeter gasketing at all smoke labeled openings.

Fire Labeled Gasketing: :Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies.

Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.

Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

Acceptable Manufacturers:

McKinney Weatherstripping Products (MW).
Pemko Manufacturing (PE).
Trimco (TR)

2.8 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.9 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

Antimicrobial Finishes: Where specified, finishes on locksets, latchsets, exit devices and push/pull trim to incorporate an FDA recognized. Silver Ion, antimicrobial coating (MicroShield™) listed for use on equipment as a suppressant to the growth and spread of a broad range of bacteria, algae, fungus, mold and mildew.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide complete installation of finish hardware items as indicated on Drawings and as specified herein.

B. Mount hardware as recommended by respective manufacturer.

C. Mount door (room) hardware items at heights and locations on doors and frames in accordance with "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by Door and Hardware Institute, except where specifically indicated otherwise.

D. Set hardware items plumb and level and secure with proper fasteners.

3.2 TRAINING

A. After delivery of, but before installation of the hardware, the General Contractor shall coordinate and schedule hardware installation training. The training will be conducted on the installation of locksets, door closers, exit devices, overhead stops and electromechanical hardware conducted by the manufacturer’s representative for each of the product categories. The training shall be conducted on the job site with the installers of wood, hollow metal and aluminum doors in attendance. Any installer working with low voltage wiring of electromechanical hardware shall be in attendance.

3.03 APPLYING HARDWARE

A. Hardware specified in this Section shall be fitted, installed and adjusted.

B. For Pupils Toilets, secure wall type door stops to wood blocks bolted to walls or partitions.

C. Use screws and/or bolts furnished by the manufacturer of the hardware item and install in accordance with the manufacturer's instructions and templates and as required. Install full complement of screws and/or bolts.

D. Self-tapping or TEK screws are not permitted.

E. At completion of Project, leave hardware in perfect condition, free from stains, varnish, scratches and mars. Half-surface butts shall be bolted on doors with nuts on hinge side of doors.

F. Card holders shall be installed on doors as indicated on Drawings with bottom of holder 5' above floor.

G. No surface hardware, except butts and pivots, shall be installed before final coat of paint or varnish has been applied.

3.04 CLEANING AND ADJUSTING

A. Clean hardware items thoroughly and adjust for proper operation.

3.05 KEY OPERATION AND INSPECTION

A. Upon completion of the building and after locks have been secured in proper positions, keys belonging thereto shall be fitted and made to work freely in respective locks in the presence of an GCU's Representative. The required number of keys for each lock, properly marked, shall be delivered to the GCU, who will give a receipt therefor.

3.06 EXISTING BUILDING MODIFICATION

A. Existing Doors Modified for Disabled

Provide the following:

1. Remove existing locksets and replace with new locksets as scheduled below.

2. Add kickplates as described in Art. 2.06,B. to push side of wood doors.

3. Replace existing door closer with new closer as specified in Art. 2.05, Subpara. E.,2.,a. herein.

B. Removals

1. Where doors are designated to be removed as part of Contract, locksets, knobs, closers, butts and other hardware shall be removed from the doors and shall remain the property of the GCU.

2. Where existing locksets are specified to be removed from existing doors to remain and replaced with new disabled locksets as part of Contract, locksets shall be removed from these doors and remain the property of the GCU.

3. Removed hardware shall be delivered to GCU

C. Contractor shall furnish the GCU with an itemized breakdown of removed hardware. A signed receipt shall be obtained from the Central Shops shall be submitted with request for final payment.

D. Unless otherwise specified, new locks for interior doors shall be masterkeyed in sets as hereinafter designated and grand masterkeyed for entire building.

E. Unless otherwise specified, all locks shall be provided with three (3) keys. Keying for new locks shall be incorporated into keying system of the existing building.

F. Where rooms have two entrances from corridor or adjoining rooms, locks for these doors shall be keyed alike.

PART 4 – SCHEDULES AND KEYING

4.01 FINISH HARDWARE SCHEDULE

A. Provide hardware for each door, each pair of doors, and each set of doors, in compliance with "Hardware Set Numbers" indicated in Door Schedule on Drawings, and as specified herein.

Manufacturer's names and product designations for hardware types are listed for the purpose of establishing minimum requirements. Provide the product specified or comparable product of other manufacturer's listed in Art. 2.01 for each hardware type.

Item	Quantity	Mfr. & Cat. No.
<u>SET 1</u>		
Elevator Machine Room:		
1. Butts	1-1/2 Pair 4-1/2"x4-1/2"	McKinney TB2714

2.	Lockset		Sargent 8204 LW1B
3.	Surface Mounted Door Closer	1	LCN 4014
4.	Overhead Stop without Holder	1	Glynn Johnson 81 Series
5.	Smoke seal		Pemko S44D

SET 2

Electrical Shed (single):

1.	Butts	1-1/2 Pair 4-1/2"x4-1/2"	McKinney TB2714
2.	Pulls (one each door)	1	Rockwood 130
3.	Overhead Stops	1	Glynn Johnson 81 Series
4.	Surface Bolts (top and bottom of inactive door)	1	Ives SB453, 8” long
5.	Silencers(2 each leaf at door head	2	Ives SR64
6.	Security Lock		Yale 197 Vertical Boltlock

SET 3

Electrical Shed (double):

1.	Butts	3 pairs 4-1/2"x4-1/2"	McKinney TB2714
2.	Pulls (one each door)	2	Rockwood 130
3.	Overhead Stops	2	Glynn Johnson 81 Series
4.	Surface Bolts (top and bottom of inactive door)	2	Ives SB453, 8” long
5.	Silencers(2 each leaf at door head	4	Ives SR64
6.	Security Lock		Yale 197 Vertical Boltlock (Mount on inactive door when doors swing out.)
7.	Overhead Stop with Holder (one each door)	2	Glynn Johnson 81 series

4.02 KEYING

A. General Keying Requirements

1. Unless otherwise specified, locks for corridor doors shall be master keyed with GCU Card Access System.

2. Unless otherwise specified locks for all doors shall be master keyed in sets as hereinafter designated and grand master keyed for the respective floors and great grand master keyed for the entire building. Unless otherwise specified, furnish three keys for each lock.

3. For existing buildings, incorporate keying for new locks into existing keying system.

END OF SECTION 087100

SECTION 087300 - THRESHOLDS, WEATHERSTRIPPING AND SEALS

PART 1 - GENERAL

1. 1 DESCRIPTION OF WORK

A. Provide thresholds, saddles, weatherstripping, seals and astragals as shown on Drawings and as specified herein.

1.2 REFERENCES

A. References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

1. American National Standards Institute (ANSI).
2. American Society for Testing and Materials (ASTM).
3. National Fire Protection Association (NFPA).
4. Builders Hardware Manufacturers Association (BHMA).
5. Underwriters Laboratories, Inc., (UL).
6. American Architectural Manufacturers Association (AAMA).

1.3 SUBMITTALS

A. Product Data

Catalog sheets, specifications, installation and maintenance instructions for each item and type.

B. Samples

1. Color Samples:

a. Color anodized Aluminum: Manufacturer's standard colors, as selected by the Architect.
b. Bronze: Manufacturer's standard finish, as selected by the Architect.

1.4 QUALITY ASSURANCE

A. Fire Rated Products

Comply with Underwriter's Laboratories, Inc. (UL); Warnock Hersey International, Inc., (WHI); or Factory Mutual System (FM) Standards, and time ratings in hours listed in each directory list.

B. Use resilient or flexible stripping and seals that are easily replaceable and available during anticipated life of building.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products of this Section as recommended by manufacturer to protect from damage.

B. Inventory products immediately upon delivery.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Zero International, Inc., Bronx, NY.

B. Accurate Metal Weatherstripping Co., Mt. Vernon, NY.

C. Pemco, Ventura, CA

D. Reese Enterprises, Inc., Huntington Beach, CA.

E. Safe-T-Metal Co., Inc., Garden City Park, NY.

F. National Guard Products, Memphis, TN.

2.2 MATERIALS

A. Metals

1. Extruded Aluminum: Alloy 6063, hardness T5 or T6.

2. Extruded Architectural Bronze: Brass Alloy 385.

3. Stainless Steel: Rolled, non-magnetic, Type 300.

B. Neoprene

Minimum chlorine content 12 percent.

1. Solid Neoprene: Mil R-6855E, Class II, Grade 40.

2. Closed Cell Neoprene: ASTM D6576, Type II, Grade A, B, C.

C. Polypropylene

American Architectural Manufacturer's Association (AAMA), 701.1 Standards.

D. Fasteners

Builders Hardware Manufacturers Association (BHMA), Standard 1001, unless otherwise specified.

2.3 EXTRUDED THRESHOLDS

A. Types

1. Type 1: Single piece saddle.

2. Type 2: Adjustable width saddle.

a. Adjustable Construction: 3 piece interlocking. Width: Minimum 5" and less than 7".
b. Adjustable Construction: 5 pieces interlocking. Width: Minimum 7" or greater.

Provide adjustable width saddles generally at building entrance doors, doors opening off Auditorium platform or stage, Gymnasium doors, Dance Classroom doors.

3. Type 3: Rabbeted with stop strip.

a. Thermal Barrier: Hollow neoprene bulb.
b. Thermal Barrier: Closed cell sponge neoprene.
c. Thermal Barrier: Pile insert.

B. Metal

Stainless steel

C. Surface Pattern

1. Abrasive tread for single piece saddle.

2. Grooved tread for adjustable width saddle.

D. Fasteners

Stainless steel Thresholds: Solid brass Phillips flathead wood screws, or flathead machine screws as anchors, appropriate for substrate.

2.4 SPECIAL ACCESSORIES

A. Disabled Ramps

Metal and finish to match threshold type.

B. Cover Plates for Door closers

Construction and finish to match threshold type. Openings and cutouts for hardware unit spindles. Coordinate fabrication with final approved hardware schedule and necessary templates.

2.5 DOOR BOTTOM PROTECTION

A. Automatic Door Bottoms

1. Mounting: Surface; stop face. (Hinge face for swing-in exterior doors).

2. Housing: Extruded aluminum, main walls and flanges, minimum 0.062" thick.

3. Finish:

Aluminum: Clear anodized.

4. Seal: Closed cell sponge neoprene.

5. Fasteners: Manufacturer's standard or recommended fasteners in compatible material and matching finish, unless otherwise specified.

2.6 DRIP CAPS

A. Provide drip caps for exterior doors not protected from precipitation.

B. Types

1. Sill Protection.

2. Top Protection: Extended rain drip cap.

C. Metal

Stainless steel

D. Finish

Anodized to match door finish.

E. Fasteners

Manufacturer's standard or recommended fasteners in compatible material and matching finish, unless otherwise specified.

2.7 HEAD AND JAMB WEATHERSTRIPPING AND SEALS

A. Interlocking Metal Type

1. Mounting: Surface.

2. Metal: Stainless steel 0.052" thick.

3. Finish:

a. Mill

4. Fasteners: Manufacturer's standard or recommended fasteners in compatible material and matching finish, unless otherwise specified.

C. Spring Metal Type

1. Mounting: Surface.

2. Metal:

a. Spring stainless steel, minimum 0.005" thick.

3. Finish: Mill.

4. Fasteners: Manufacturer's standard or recommended fasteners in compatible material and matching finish, unless otherwise specified.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install Work in accordance with manufacturer's printed instructions, except as shown or specified otherwise.

NOTE: Refer to Section 07900: “Joint Sealers” for sealant types.

B. Level and align thresholds with frames and doors. Where required, use non-corrosive shims.

1. Exterior Doors: Set threshold in a solid bed of “Type 3” sealant.

2. Secure thresholds to substrate with countersunk fasteners.

C. Install surface mounted automatic door bottom between stops with activating rod on hinge side of door.

D. Mount sweep type door bottom protection/drip caps on exterior side of doors.

1. Before mounting apply “Type 2” sealant on the backside of bearing surface. Secure to door with required fasteners.

E. Weatherstripping and Seals

1. Starting at head, install continuous stripping at each opening without unnecessary interruptions at door corners and hardware.

2. Secure fasteners for stripping and seals so they will not work loose during door operation. Exposed heads of fasteners shall be free of sharp edges.

3. Coordinate meeting seals with hardware before installation.

4. Install units plumb and level at optimum location to maintain a permanent effective seal.

3.2 ADJUSTING AND CLEANING

A. Adjust stripping and seals, if necessary, to achieve an effective seal for proper operation of doors and hardware.

B. Clean exposed surfaces by methods recommended by manufacturer.

END OF SECTION 087300

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SECTION 089700 - STRUCTURAL GLASS WALLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Glass, glazing and connections for the all glass suspended façade in accordance with Contract Documents.

B. Related Sections:
Section 051200 – Structural Steel
Section 055000 – Misc. Metals
Section 079000 – Sealants for Glazing

1.2 QUALITY ASSURANCE

A. Special Experience Requirements for Installer: The contractor or subcontractor performing the work of this section must, within the last five (5) consecutive years prior to the bid opening, have successfully completed in a timely fashion at least three (3) projects similar in scope and type to the required work.

B. Special Experience Requirements for Manufacturer: The manufacturer providing the structural glass system specified in this section must, for the past five (5) years, have been regularly engaged in the manufacture of structural glass systems similar in type to that required for this project. Such similar structural glass systems provided by the manufacturer must have been in satisfactory service for not less than five (5) years.

C. Glazing material and system design: Glass, glazing, system design and accessories are the sole responsibility of the glass manufacturer.

D. Provide installation by installer acceptable to manufacturer. Provide a letter signed by representative of Manufacturer with company's authorization stating that installer is acceptable and qualified to install system.

1. The installer of the glazing system is responsible for supplying and erecting the complete structural glazing system, coordinating and maintaining tolerances between structure and glazing system with individual suppliers and manufacturers, and installation of glazing system. Installer to be approved by the glazing manufacturer in writing.

E. Where safety glass is indicated, provide type of products which comply with ANSI Z97.1 and testing requirements of 16 CFR, Part 1201 for category II materials.

F. Provide previously tested system which complies with ASTM E331) water penetration of exterior windows) and ASTM E283 (determining rate of air and leakage for exterior windows).

1. Air infiltration shall not exceed 0.06 cfm/ft2 of WALL area and a test pressure differential of 6.24psf.

2. There shall be no water leakage on interior surface of glass or perimeter when tested to 12psf with a water application rate of 5gph/ft2 for fifteen minutes.

3. Manufacturer must show previous testing and provide results for a similar structural glass project.

1.3 SYSTEM DESCRIPTION

A. The drawings and specifications for the structural glass system are based on the Pilkington Planar System. The contractor may submit for approval a structural glass system from a different manufacturer. Any structural glass system from a different manufacturer will be approved if the Commissioner determines that such system is equivalent to the Pilkington Planar System in performance and function.

1. Substitutions from the the following manufacturers will only be accepted if they meet all performance criteria listed in the specification:

a. Seele
b. Gartner

B. Design Requirements:

1. Wind Load Enclosure (Typical) 30psf
Wind Load Wind-Screen (Typical) 37psf

2. Seismic Zone to be less than 0.005.

3. Live load deflection of supporting structure if any L/360

C. Glazing System:

1. Fittings are designed to give flush appearance to outward surface of glazing system with no exposed fitting heads. **NO EXTERIOR FITTINGS OR PLATES WILL BE PERMITTED.**

2. The engineering of the countersunk fittings is the sole responsibility of the glass manufacturer. All fitting sizes must be in accordance with profiles and sizes shown on drawings. Size of fittings is critical to the design of the glass wall.

3. Spring plate members are designed to prevent high stress concentration at the hole positions and must cope with:

a. Negative and positive wind loading
b. Seismic loads

c. Thermal movement
d. Construction tolerances
e. Live load and dead load movements

4. Movement diaphragms of stainless steel and durable flexible discs must be incorporated in connections to accommodate oversize holes in spring plate members which allow for thermal movement and glass manufacturing tolerances.

5. The system shall provide for unitized pre-fixing of all items to glass prior to erection.

1.4 SUBMITTALS

A. Submit the following:

1. Shop Drawings: Shop drawings shall clearly indicate materials and methods, indicate coordination with other trades, and bear signed approval of the glazing system manufacturer and the glazing system installer, as well as the stamp of a licensed Professional Engineer in the State of New York. Drawings shall show sections, dimensions, and the connection with other work.

2. Setting Drawings: Submit setting drawings, numbered and marked to correspond with numbers and other marks on the glazing system. These drawings shall also show all other necessary data to properly and efficiently set the material.

3. Product Data: Material description and installation instructions for tapes, compounds, gaskets and other materials.

4. Samples:

a. Submit two (2) samples of glass and glazing materials required for the Project. Samples of glass shall be 12" x 12". Include glass holes properly located in relation to the corner.
b. Submit sample of countersunk fitting complete with glass, bolt and accessories.
c. Submit samples of plate to plate silicone sealant. Sealant or gasket shall be proper size and color and should be 12” long.
d. Submit samples of frit pattern (color and pattern to be coordinated with architect) embedded in glass 12” x 12”.

5. Quality Assurance Compliance: Submit letters from glass manufacturer’s authorized representative and from the project installer stating that they are in compliance with the requirements of the Contract Documents.

6. Calculations: Submit calculations proving structural glazing systems performance and compliance with specified loads with stamp of licensed Professional Engineer registered in the State of New York.

7. Letter signed by the glass manufacturer clearly stating the glass and fittings to be used on the project are part of the manufacturer's system and are acceptable to the manufacturer and that they have reviewed the contract documents and will issue a project specific 12-year warranty including the entire system on the letterhead of the system manufacturer.

1.5 WARRANTIES

A. Comprehensive Warranty for both Manufacturer and Installer: Provide the glass manufacturer's twelve year warranty for the design integrity, weatherability and durability of the glazing system. Partial multiple warranties of various project elements will not be accepted. Warranty must cover all aspects of the system including engineering, glass, fittings, and installation. The warranty must be written on the letterhead of the system manufacturer. Warranties written on a subcontractor's letterhead are not acceptable.

B. Warrant the installation for a period of **five years** for installation and repairs of failures. Provide written requirements for notification of installer and terms for maintaining warranty provisions. Do not contradict the requirements of the Contract Documents.

C. The Warranties submitted under this Section shall not deprive the Owner of other rights or remedies that the Owner may have under other provisions of the Contract Documents and the laws of governing jurisdictions and is in addition to and runs concurrently with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Glass Wall System: Provide engineered glass and fittings to achieve the design intent set forth here and as shown on the drawings and the System Description identified in Section 1.3.A:

1. Movement diaphragms of stainless steel and durable flexible discs must be incorporated in connections to accommodate oversize holes in spring plate members which allow for thermal movement and glass manufacturing tolerances. Spring plate members are designed to prevent high stress concentration at the hole positions and must cope with:

   a. Negative and positive wind loading
   b. Seismic loads
   c. Thermal movement
   d. Construction tolerances
   e. Live load and dead load movements

2. Provide unitized pre-fixing of all item to glass prior to erection.
3. Complete all edgework, holes and notches before the glass is tempered.

4. Provide Mockup of the system for approval by Commissioner.

B. Glass Type: See makeup listed below.

1. All glass must be fully tempered and heat soaked.

   Minimum glass thickness shall be as follows:

   Vertical Walls: Low-Iron Laminated Glass
   Glass to be 22mm Optiwhite Low-Iron SGP Laminated Glass to be composed of: 10mm Optiwhite Low-Iron Outer lite with 1.52mm SGP interlayer laminated to 10mm Opthiwhite Low-Iron inner lite.

   Canopy and Wind-Screen Glass: Silk-Screened Low-Iron Laminated Glass
   Glass to be 22mm Optiwhite Low-Iron SGP Laminated Glass to be composed of: 10mm Optiwhite Low-Iron Outer lite with Standard 20% White Dot Silk-Screen Frit Pattern on the #2 Surface with 1.52mm SGP interlayer laminated to 10mm Opthiwhite Low-Iron inner lite.

2. Glass must be certified to be tempered to a minimum compressive strength of 16,000 psi. The structural steel has been designed assuming a minimum compressive strength of 16,000 psi. Glass tempered to lower strengths will not be accepted. Submit written certification from the glazing manufacturer.

3. All glass must be horizontally tempered eliminating tong marks.

4. All tempered glass must be heat soak tested to convert nickel sulfide inclusions from the alpha phase to the beta phase so that the glass will fracture in the test. Heat soak must comply with the European Din standard requiring a minimum 12 hour cycle at a temperature of 290c and must be warranted for twelve years as part of the system warranty.

5. Written warranties against nickel sulfide inclusions in lieu of heat soaking will not be accepted.

6. All edges will be ground flat with a frosted appearance unless otherwise noted.

7. All edgework, holes and notches in the tempered glass panels will be completed before tempering and shall comply with the requirements of Pilkington Architectural as stated below:

   a. Dimensional tolerance on panel size will be ± 1 mm of the theoretical dimension required.

   b. Squareness of each panel will be within 3 mm.

   c. Bow allowance is 0.1%.

d. The positional tolerances on all holes will be ± 1 mm from a single datum point.

e. Holes for hardware are to be 60mm from edge of glass to keep hardware sizes to a minimum.

8. Flatness of glass is a key element of this specification. Average tempered glass rollerwave distortion must be certified not to exceed an average of 0.0007" peak to valley, with a maximum sag at the leading and trailing edge of 0.25 mm. A site inspection if required for roller wave and bow tolerances should be from a minimum distance of 3 meters.

9. All glass must be manufactured in a factory where the quality control procedures are created under the terms of ISO 9000 and are independently monitored.

10. Prestress glass around holes to a level which is compatible with the design and use of the fittings. Check by differential surface refractometer on stress level.

C. Fittings:

1. 905 fitting bodies shall have a diameter of 40mm. Fittings to have 19mm countersunk bolt heads. Rods will have a diameter of 17mm with 21mm ball and must be fabricated from type 316 high strength stainless steel with a machined finish. Larger "Spider" type fittings that are castings will not be acceptable. Hardware shall be designed to keep sizes to a minimum and edge distance for hardware holes shall be kept to 60mm.

2. AESS Steel blade outriggers and gussets to support fittings to be 3-coat epoxy painted. Final design and size to be determined by manufacturer.

3. The subcontractor shall demonstrate to the Commissioner's satisfaction that the stresses induced in the glass by these fittings are compatible with the strength of the glass and the needs of the performance section of this specification.

4. The finish of all stainless steel fittings will be "as machined".

5. Spring plates of all fittings to comply with these specifications. The design shall be shown by the Subcontractor to be compatible with the performance specification in all respects.

a. Spring plates shall provide a tolerance capability which will cope with the full range of movements shown below:

1) Thermal movements occurring as a result of differential coefficients of thermal expansion within the range specified. The components used within the system shall withstand noiselessly all thermal movements without any buckling, distortion, cracking, failure of joint seals or undue stress on the glass or fixing assemblies.
2) Deflection of edge beams due to loading applied after erection of the cladding to magnitude specified.

3) Maximum side sway of structure due to wind load to the magnitude specified or seismic movement dot the degree specified.
4) Deflection due to self weight of the glass system.
5) Inward and outward movements due to the design wind loads specified.

6. Countersunk hardware bolts will be bright machine finished, socket head bolt diameter 1-1/8” with hexagonal shank, stainless steel Type 303.

   a. No exterior plates, caps, disks or buttons will be permitted.

7. Bushings will be Nylatron Polyamide.

8. Gaskets will be fully fully vulcanized fiber, neoprene or precured silicone.

9. Perimeters shall be .250 clear anodized aluminum engineered by and installed by this section. Perimeters to be clad in .060” thick type 304 stainless steel cladding where exposed.

PART 3: EXECUTION

3.1 EXAMINATION

A. Examine surfaces receiving the Work. Verify dimensions of in-place and subsequent construction. Follow the recommendations of the FGMA as to inspection procedures. Do not begin work until unsatisfactory conditions have been corrected. Installation of work shall constitute acceptance of the related construction.

3.2 PREPARATION:

A. Pre-Installation Meeting: Meet at the project site with the representatives of the glass and glazing materials manufacturers, architectural exposed structural steel fabricator and erector, sealant manufacturer, the glazing installer, Architect's representative and Owner's representative. Review the glazing procedure and schedule, including the method of delivering and handling glass, and installing glazing materials. The chemical compatibility of all glazing materials and framing sealants with each other and with like materials used in glass fabrication shall be established.

3.3 INSTALLATION OF GLASS:

A. Install in accordance with manufacturer’s requirements and the shop drawings. This section is responsible for installation of all miscellaneous metal clips, bracings, angles, etc., that are called out as part of the structural glass system.

B. Employ only experienced glaziers who have had previous experience with the materials and systems being applied. Use tools and equipment recommended by the glass manufacturer.

C. Plate to plate joints of glass are sealed with silicone sealant. Joint dimensions shall be designed to be compatible with sealant properties and live load movement of the structure.

D. Bolt Torque: Torque bolts to torques specified on shop drawings using calibrated tool. Lock torqued bolts into position to prevent backoff. Reset calibrations regularly to ensure accurate torquing.

E. Maintain a minimum temperature of 40 degrees F. during glazing unless the manufacturer of the glazing material specifically agrees to application of this material at lower temperature. If job progresses or other conditions require glazing work when temperature is below 40 degrees F. (or below the minimum temperature recommended by the manufacturer), consult the manufacturer and establish the minimum provisions required to ensure satisfactory work.

F. Clean glazing connectors receiving glazing materials of deleterious substances which might impair the work. Remove protective coatings which might fail in adhesion or interfere with bond of sealants. Comply with manufacturer's instructions for final wiping of surfaces immediately before application of primer and glazing sealants. Wipe metal surfaces with xylol or toluol.

G. Inspect each unit of glass immediately before installation. Glass which has significant impact damage at edges, scratches or abrasion of faces, or any other evidence of damage shall not be installed.

H. Sealants: Prime surfaces to receive glazing sealants where required, in accordance with manufacturer's recommendations, using recommended primers.

I. Locate setting blocks, if required by the drawings, at the quarter points of sill, but no closer than 6 inches to corners of glass. Use blocks of proper sizes to support the glass in accordance with manufacturer's recommendations.

J. Provide spacers to separate glass from spring plates.

K. Set glass in a manner which produces greatest possible degree of uniformity in appearance. Face all glass, which has dissimilar faces, with matching faces in the same direction.

L. Use masking tape or other suitable protection to limit coverage of glazing materials to the surfaces intended for sealants.

M. Tool exposed surfaces of glazing materials.

N. Clean excess sealant from glass and support members immediately after application, using solvents or cleaners recommended by manufacturers.

3.4 CURING, PROTECTION, AND CLEANING

A. Cure sealants in accordance with the manufacturer's instructions to attain maximum durability and adhesion to glass.

B. Clean all surfaces after installation, leaving all in a clean and workmanlike manner.

C. Final cleaning and protection after installation is the responsibility of others.

END OF SECTION 089700

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SECTION 099000 - PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes surface preparation and field painting of the following:

1. Exposed exterior items and surfaces.

2. Exposed interior items and surfaces.

3. Surface preparation, priming and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface as directed by the Architect. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.

1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels as described in Article 2.05A.

D. When removing or disturbing existing paint on surfaces that have not been tested by the RIOC for lead content, assume that the existing paint contains lead. Take necessary precautions to protect workers. Provide measures to separate paint removal work areas from occupied areas, and clean-up and disposal as specified in Specifications Section S01900 - Existing Premises Work.

1.2 REFERENCES

A. References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

1. Federal Specifications (FS)

2. American Society of Testing and Materials (ASTM)

3. N.Y.S. Department of Environmental Conservation

4. U.S. Department of Labor

5. Occupational Safety and Health Administration (OSHA)

6. Steel Structures Painting Council (SSPC)

7. Department of Defense (DOD)

1.3 DEFINITIONS

A. The term "Painting" as used in this Section, means the application of all coatings such as paint, primer, enamel, varnish, shellac, oil, etc. as listed in the Painting Schedules.

B. The term "Painting" also includes preparation of surfaces for such applications, and the clean-up as hereinafter specified.

C. The term "Walls" means all surfaces from floor, or top of base, or top of wainscot, to ceiling or hung ceiling.

1. Include pilasters, breaks, jambs, reveals, returns, arches.

2. Include hardboards, pegboards.

3. Include free standing columns, low partitions.

4. Include masonry, plaster or gypsum board interiors of wardrobes or closets, cupboards and other enclosed spaces.

D. The term "Ceilings" means the general overhead horizontal surfaces.

1. Include cornices, arches, soffits, stair soffits.

2. Include beam and girder haunches.

3. Include primed metal cover and border strips.

4. Include metal frame of ceiling lights and ceiling equipment.

5. Include side faces of hung or furred ceiling.

E. Touching-up bare spots specified for previously primed or painted surfaces is in addition to the coats specified for the paint system.

F. Finishes:

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.

2. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.

3. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.

4. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

G. Concealed: The term “concealed” refers to surfaces, piping, ducts or conduit which cannot be accessed without moving a building element such as within a chase, wall or ceiling.

1. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

a. Furred areas.
b. Ceiling plenums.
c. Duct shafts.
d. Elevator shafts.

H. The term “exposed” refers to any item which is not concealed.

1. The term “exposed to public view” means situated so that it can be seen from eye level from a public location. A public location is that which is accessible to persons not responsible for operation or maintenance of the building.

1.4 SUBMITTALS

A. Product Data

Provide manufacturers' product literature for all materials specified and material manufacturer's printed directions and recommendations for environmental conditions, surface preparation, priming, mixing, reduction, spreading rate, application, storage and VOC content, as applicable for each of the materials specified.

B. Samples

1. Initial Selection

Submit manufacturer's color charts for each type of finish for approval by the Project Architect. Verify colors specified with manufacturers' color charts for availability and notify the Project Architect if any discrepancies should occur.

2. Verification prior to installation

a. Contractor shall furnish color chips for surfaces to be painted.
b. Submit two samples of each color and finish selected on 12" x 12" hardboard.
c. Two samples of finish on concrete masonry and metal surfaces.

3. All samples shall be labeled; and include the following information:

a. Manufacturer's name
b. Type of paint/stain/hardener
c. Manufacturer's stock number
d. Color: name and number
e. Federal Specification number, as specified
f. Federal regulations for amount of lead in paint.
g. VOC content

C. Quality Assurance

1. Certification that materials for each system are obtained from a single manufacturer.

2. Certification that Work shall be performed by personnel with a minimum of three years experience who meet the qualifications set forth in OSHA, 29 CFR 1926.62 (Lead In Construction Standard).

3. Certification that material meets or exceeds the performance requirements of Federal Specifications.

4. Certification that materials comply with N.Y.C. and N.Y.S. regulations for Volatile Organic Compounds.

5. For photoluminescent paint system, submit NYC MEA Acceptance Reports or certification of required test results by an Approved Agency.

D. Testing

Toxicity Characteristic Leaching Procedure (TCLP) testing per Article in Part 3 titled “Disposal of Painted Waste and Debris from Existing Buildings”.

E. Guarantee

Provide Guarantee per Article 1.08.

F. Low Emitting Materials Compliance Submittals:

1. Provide documentation for each coating to be used on the building interior indicating that the coatings comply with low V.O.C. requirements as stated in Specification Section G01600.

1.5 QUALITY ASSURANCE

A. General

1. All painting materials shall arrive at the job ready-mixed.

2. Remove all rejected materials from the premises immediately.

3. All thinning and tinting materials shall be as recommended by the manufacturer. Generally, all paints shall not require additional thinning.

4. Verify that the specified shop prime paint for each applicable item in this Project is compatible with the total coating system, prior to application.

5. Materials selected for each system type shall be products of a single manufacturer.

B. Qualifications

1. Work of this Section shall be performed by personnel with a minimum of three years experience in performing this type of Work.

2. The Contractor shall ensure that all employees meet the qualifications set forth in OSHA, 29 CFR 1926.62 (Lead In Construction Standard).

C. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

D. Regulatory Requirements

1. N.Y.C. Building Code, latest edition

2. N.Y.S. Department of Environmental Conservation - Part 205 on "Architectural Surface Coatings" - for (VOC) Volatile Organic Compounds.

3. Steel Structures Painting Council (SSPC).

4. U.S. Department of Labor, Occupational Safety and Health Administration, Construction Industry Standards (29 CFR 1926/1910) Revised 10/1/79, Washington, D.C.

5. Occupational Safety and Health Administration (OSHA) 29 CFR 1926.62 (Lead In Construction Standard).

6. New York State Department of Environmental Conservation regulations, 6 NYCRR part 364.

7. New York City Department of Environmental Protection Waste water disposal permitting requirements.

E. Certifications

Federal Specifications: When materials are specified to comply with Federal Specifications, products will be accepted which meet or exceed the performance requirements of such Federal Specifications and comply with all regulations currently in effect.

1. Indicate that material complies with Federal Specifications by including the Federal Specifications number on the container label or on the product literature, or submit a statement with the Product Data stating that material meets or exceeds the performance requirements of the Federal Specifications.

F. Field Samples

1. Provide samples of each color and finish, under natural lighting conditions, in a location where each finish is to be applied.

2. RIOC will request review of first completed room, space or item of each color scheme required by the Project Architect for color, texture and workmanship.

3. First acceptable room, space or item will be used as project standard for each color scheme, or finish.

4. Primer coat is to be inspected and approved in all locations before any subsequent finish coats are applied.

5. In existing building locations; repair of existing base surface is to be approved prior to commencement of painting.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery

Deliver materials to the site in original, unopened containers bearing manufacturers name and label containing the following information:

1. Product name or title of material

2. Manufacturer's stock number, batch number, VOC content in grams per liter and date of manufacture.

3. Manufacturer's name

4. Federal Specification number, if applicable.

5. Federal regulations for amount of lead in paint (less the 0.06% lead in non-volatile ingredients)

6. Contents by volume for major pigment and vehicle constitutions

7. Thinning instructions

8. Application instructions

9. Color name and number

B. Storage

1. RIOC's Representative will designate space on premises for storage of materials. Contractor shall restrict storage in this area to paint materials and related equipment, and provide the following:

   a. Provide one (1) approved chemical dry fire extinguisher equal to 20 lb. CO_2 rating in all assigned rooms or locations where painting materials are stored. Fire extinguisher shall bear the label of the National Board of Fire Underwriters and tag of most recent inspection.

   b. Provide three (3) standard size red fire pails with clean sand in above locations. At the completion of project, fire extinguishers and pails shall become property of Contractor.

2. Maintain storage area in clean condition, store materials not in use in tightly covered containers. Remove oily rags, waste and empty containers from site each night.

3. Provide RIOC's Representative with one key for each space if spaces are to be kept locked when not in use.

4. Protect all materials from freezing.

1.7 PROJECT CONDITIONS

A. Environmental Requirements

1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied.

2. Do not apply finish in areas where dust is being generated or will be generated while the material is drying.

3. Provide paint and coating products to comply with applicable environmental regulations, VOC requirements and local authorities.

4. The Contractor shall ensure that all requirements of OSHA 29 CFR 1926.62 (Lead in Construction Standard) are adhered to during the project. In addition, the Contractor shall ensure that proper work area protection and clean-up procedures (as described in this Section) are strictly adhered to during all phases on the project.

1.8 GUARANTEES

A. Adherence of workmanship and materials to Specifications requirements shall be maintained for the one year Contract guarantee period. These requirements shall include the following:

1. There shall be no evidence of blistering, peeling, crazing, alligatoring, streaking, staining, or chalking.

2. Dirt shall be removed without blemishing the finish by washing with mild soap and water.

3. Colors of surfaces shall remain free from serious fading; the variation, if any, shall be uniform.

B. Correct all defects, appearing within the guarantee period, by removal of the defective work and replacement as directed.

C. All corrective measures shall be the Contractor's responsibility, and shall be made at no extra cost to the RIOC. The requirements set forth in Part 3 of these Specifications shall be strictly adhered to.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with specified requirements, provide "First Line" or "Top Quality" products of one of the following manufacturers:

1. Benjamin Moore and Co.

2. Devoe and Reynolds Co.

3. Glidden Coatings and Resins.

4. PPG Industries, Pittsburgh Paints Inc.

5. Pratt and Lambert

6. The Sherwin-Williams Co.

7. Tnemec Company, Inc.

8. MAB Paints

9. Carboline

10. Mercury Paint Corp.

2.2 MATERIALS

A. Provide products which meet all N.Y.S. Part 205-VOC requirements for applications outlined herein and comply with low V.O.C. requirements as stated in Specification Section G01600.

B. Provide products which meet all Federal regulations for amount of lead in paint (less than 0.06% lead in non-volatile ingredients).

C. Provide best quality grade of various types of coatings as regularly manufactured by the paint materials manufacturers. Materials not displaying manufacturers' identification as a standard, best-grade product will not be acceptable.

D. Use only thinners approved by paint manufacturers for applications intended and use only within recommended limits.

2.3 REFERENCE STANDARDS

A. Paint materials shall meet or exceed the requirements of the following standards:

Federal Specifications

1. Primers, Sealers, Undercoats

a.	Metal Primer for Galvanized surfaces:	FS TT-P-001984 FS TT-P-650-C
b.	Metal Primer Aluminum or Steel surfaces:	FS TT-P-57B
c.	Primer Sealer, Latex Base:	FS TT-P-650C
d.	Alkyd Primer (Corrosion Inhibiting) Lead and Chromate Free: VOC Complying	 FS TT-P664C
e.	Acrylic Primer:	TT-P-650-C

2. Finish Paints

a.	Exterior Alkyd Modified Paint; Gloss:	FS TT-P-102E, Type II and Type III
b.	Ext. Acrylic Latex Paint; Flat:	FS TT-P-19
c.	Gloss Acrylic Latex Enamel:	FS TT-P-1511-B
d.	Flat Vinyl Acrylic Latex Interior:	TT-P-29J
e.	Semi-Gloss Vinyl Acrylic	

	Latex Enamel, Interior:	TT-P-1511-B
f.	Alkyd Odorless Semi-Gloss Enamel: FS TT-E-509C for white and tints; Class A for deep colors.	FS TT-E-529
g.	Aluminum Paint (Ready Mixed):	FS TT-P-38D.
h.	Heat Resistant Semi-Gloss Enamel (400°F max. surface temperature):	FS TT-E-496
i.	Asphalt Varnish:	FS TT-V-51

3. Floor Finishing Systems

a.	Rubber Base Paint: For use over concrete and masonry	FS TT-P-91
b.	Cement Floor Hardener - Magnesium Zinc and Fluosilicate type as specified in Section 03300 of this Specification.	
c.	Urethane Floor Paint:	FS TT-C-542, Type II
d.	Polyamide Epoxy Paint	FS TT-C535B Type II

4. Lettering Enamel: Interior/Exterior full gloss enamel: FS TT-E-489

5. Fire Retardant Paint: Latex Fire Retardant Paint: FS TT-P-26P Rated Class A by Underwriters Laboratories.

6. Miscellaneous Materials:

a. Mineral Spirits (Petroleum Paint Thinner): FS TT-T-291
b. Color Pigments: Pure, non-fading, finely ground pigments, at least 99 percent passing a 325 mesh sieve. Color pigments that are to be used on masonry, concrete and plaster shall be lime proof: FS-TT-P-381.
c. Putty: Linseed-Oil type for Wood Sash Glazing: FS-TT-P-791B.
d. Shellac: Two pound cut shellac - FS TT-S-300
e. Paste Wood Filler: FS TT-F-336
f. Plastic Wood Filler: FS TT-F-340C.
g. Surface Sealer: Pigmented Oil for Plaster & Wallboard - FS-TT-S-179.
h. Linseed Oil (Boiled): FS A-A-371A
i. Linseed Oil: FS A-A-379A
j. Lacquer (Brushing) Clear and Pigmented: FS-TT-L-26C.
k. Lacquer, Rubbing, Clear: FS-TT-L-57C
l. Lacquer, Spraying Clear and Pigmented for Interior and Exterior Use: FS-TT-L-58E.

B. Miscellaneous Standards and Requirements

1. Turpentine: ASTM D13.

2. Cold Galvanizing Compound: Single component material conforming to ASTM A780 giving 96% pure zinc in the dried film.

3. Cleaning Solvents: Low toxicity; flash point in excess of 100°F.

4. Spackling Compound: ASTM C475.

5. Polyester Filler: Polyester resin base autobody filler standard weight or finishing grade required by conditions; Marson's "White Lightning" and "Topcoat."

2.4 COLORS

A. Selection

1. Paint colors, surface treatments and finishes will be selected by the Project Architect.

2. Color Schedule will be issued to the Contractor after award of the Contract.

a. Final acceptance of colors will be from actual job applications.

2.5 EXTERIOR PAINT SYSTEMS

A. New Ferrous Metal
Structural steel, all ferrous metals, and steel window trim.

1st Coat - Touch up with epoxy Polyamide Paint
2nd Coat - Polyamide Epoxy Paint
applied at the rate of -- 4.0 to 6.0 Mils DFT
SSPC-PS
Guide 13.01

3rd Coat (Top Coat) - Acrylic Aliphatic
Polyurethane applied at rate of -- 1.5 to 2.0 Mils DFT
SSPC-PS
Guide 17.00
Type 5.

B. Zinc Coated Metal Exposed to Public View

Provide for all galvanized surfaces (Zinc metallizing) exposed to public view (not just on the exposed face), except chain link fences:

1st Coat - Epoxy polyamide -- 4.0 Mils DFT

2nd Coat - Exterior Aliphatic polyurethane semi-gloss enamel -- 4.0 Mils DFT

C. Zinc Coated Metal

Exterior basketball backstops, scoreboard mounting posts, bleachers.

1st Coat - Epoxy polyamide -- 4.0 Mils DFT

2nd Coat - Exterior Aliphatic polyurethane semi-gloss enamel -- 4.0 Mils DFT

D. Existing steel members embedded in masonry or concrete.

1st Coat - Epoxy polyamide equal to Tnemec Series 135 Chembuild (capable of painting on an SSPC-SP3 surface prep). -- 7 to 9 Mils DFT

E. Existing steel members exposed to view or the elements.

Provide the epoxy coat system, except the first coat shall be an Epoxy polyamide equal to Tnemec Series 135 Chembuild (capable of painting on an SSPC-SP3 surface prep).

F. Epoxy Coat System

1st Coat (Primer) - Epoxy organic zinc rich Primer with 85% zinc applied at rate of -- 2.0 to 4.0 Mils DFT SSPC - PS Guide 12.00 (Organic Zinc Rich).

2nd Coat - Polyamide Epoxy Paint applied at the rate of -- 4.0 to 6.0 Mils DFT SSPC-PS Guide 13.01

3rd Coat (Top Coat) - Acrylic Aliphatic Polyurethane applied at rate of -- 1.5 to 2.0 Mils DFT SSPC-PS Guide 17.00 Type 5.

For factory painted items, Manufacturer/Fabricator shall provide touch-up paint in sufficient amount for Project. -- 5.0 Mils DFT

G. Aluminum – Mill Finished

1st Coat - Aluminum metal primer -- 3.0 Mils DFT

2nd and 3rd Coats - Enamel gloss paint	--	2.0 Mils DFT each coat

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions

1. The application of painter's finish to any surface shall be taken to indicate that the Contractor considers such surfaces suitable for a first-class finish.

2. Do not apply painter's finish in any locations until the Work of other Contractors that might damage the new finish is completed.

3. Notify the RIOC in writing regarding Work by others that does not provide a suitable surface for the new finish.

4. In case of dispute regarding the suitability of any surface, the RIOC decision shall be final and conclusive upon all concerned.

5. Contractor shall check the compatibility of previously painted surface with the new coating by applying a test panel 4 foot wide x wall height. Allow test panel to dry thoroughly; verify proper adhesion before proceeding with painting Work.

3.2 PREPARATION

A. Protection

Cover or otherwise protect finished Work of other trades and surfaces not to be painted concurrently or not to be painted.

B. Surface Preparation

1. Perform preparation and cleaning procedures in accordance with the paint manufacturer's instructions and as specified.

a. Sand bare spots and abraded areas of shop primed and previously painted surfaces. Where paint is missing or removed, sand surrounding edges of sound paint film so edges of existing paint do not show through the finished system.
b. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease with clean cloths and cleaning solvents prior to other cleaning procedures. Program the cleaning

and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

2. Ferrous Metals

   a. Remove dirt and grease with cleaning solvents that will not affect shop prime coat. Wipe off with clean cloths.
   b. Remove rust, mill scale and defective paint down to bare metal, using scraper, sandpaper, or wire brush. Grind if necessary to remove shoulders at edge of sound paint to prevent flaws from photographing finish coats.

3. Galvanized Metal

   a. Remove dust and oil with mineral spirits and wipe dry with clean cloth. Repair welded and abraded surfaces with a 2 mil (dry) minimum thick coating of cold galvanizing compound in conformance with ASTM A780; comply with manufacturer's application instructions.
   b. Repair steel decks and cold-formed metal framing immediately following installation.
   c. For hot-dipped galvanized surfaces, allow 6 months of weathering prior to cleaning specified in a. above. Immediately before painting, roughen surface with course sandpaper. Zinc metallized surfaces do not require sanding.

4. Steel Doors and Frames

   a. Fill small dents, pits, and other minor imperfections flush and smooth with polyester filler.
   b. Apply and finish filler in accordance with manufacturer's instructions.

5. Concrete and Concrete Unit Masonry: Prepare cementitious surfaces by removing efflorescence, chalk, dust, grease and oils. Concrete and mortar shall be cured as recommended by paint manufacturer.

C. Materials Preparation

1. Mix and prepare painting materials in accordance with the manufacturer's directions.

2. Stir materials before and during application to produce and maintain a mixture of uniform density. Do not stir any film that may form on the surface of materials into the material; remove the film and strain the material before using.

3. Thinning: Use only thinners recommended by the paint manufacturer and use only within the recom-mended or specified limits.

D. Moisture Meter Test

1. Do not apply initial coating until moisture content of surface is within limitations recommended by paint manufacturer.

2. Reading shall be approximately 8% on meter.

3. Test surfaces with moisture meter at various areas e.g.: Top, bottom and middle of wall, especially where piping occurs and at exterior walls, in the presence of the RIOC.

4. Moisture content shall be approved by the RIOC before any Work is started.

3.3 APPLICATION

A. General

1. No Work shall be performed where cement or plaster is being applied or is in the process of drying.

2. No Work shall be performed in spaces that are not broom clean and free of dust and waste.

3. Apply paint materials to produce smooth finished surfaces, free of brush or roller marks, drops, runs, or sags.

4. Paint materials shall be kept at a proper and uniform consistency.

5. Thin only when necessary to achieve best results.

6. Thinners shall be material recommended by manufacturer of paint, and in quantity as recommended.

7. Excessive use of thinner as indicated by variation in absorption, lack of "hide", thickness of dry film, mottled or streaky coat, shall be cause for rejection. Correct as directed.

8. Thinning of varnish or aluminum paint prohibited.

9. Apply all coats with brush or roller, varying slightly the color of succeeding coats. Spraying will not be permitted.

   a. If recommended by manufacturer, 100% acrylic resin concrete block filler may be spray applied and shall be backrolled as necessary to work material into substrate surface.

10. Brush out or roll on first or prime coat; work well into surface.

11. Each coat shall be inspected, approved and dry before proceeding with additional coats.

12. Allow at least 48 hrs for enamels and exterior oil paint to dry.

13. The surfaces of interior woods and metals shall be sanded or rubbed between coats to assure smooth finish and proper adhesion of subsequent coats.

14. Avoid lapping of paint on glass, hardware, or other adjoining surfaces.

15. Apply no paint to operating units where sliding contact of metals is necessary for proper functioning of unit.

16. Painting is not required on walls or ceilings in concealed and inaccessible areas.

17. Moving parts of operating units will not require finish painting unless otherwise required.

18. Do not paint over any code-required labels, such as Underwriter's Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plate.

19. Finish doors on tops, bottoms and side edges same as exterior faces.

3.4 FIELD QUALITY CONTROL

A. The RIOC reserves the right to require the following material testing procedures at any time, and any number of times during period of field painting:

1. Measurement of dry film thickness (DFT) by use of a dry film thickness gauge in accordance with use and calibration requirements of Structural Steel Painting Council [SSPC], "Method of Measurement of Dry Paint Thickness with Magnetic Gauges".

2. Engage services of an independent testing laboratory, recommended by the RIOC, to sample paint being used. Samples of materials delivered to construction site will be taken, identified and sealed, and certified in presence of Contractor

3. Testing laboratory will perform appropriate tests for any or all of the following characteristics: Abrasion resistance, apparent reflectivity, flexibility, washability, absorption, accelerated weathering, dry opacity, accelerated yellowness, recoating, skinning, color retention, alkali resistance and quantitative materials analysis.

4. If test results show that material being used does not comply with specified requirements, Contractor shall be directed to stop painting Work, and

remove non-complying paint; repaint surfaces coated with rejected paint; remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are non-compatible.

a. If the samples do not comply with requirements of the Specifications, costs of testing and remediation of rejected work shall be borne by Contractor.
b. If the tests find that the samples do comply with the requirements of the Specifications, the cost of the testing will be borne by the RIOC.

3.5 CLEANING

A. General

Contractor shall clean-up behind each paint crew such that painting and clean-up will be a continuous uninterrupted operation. The practice of one general clean-up after completion of all painting will be strictly prohibited. This clean-up will include, but not be limited to the following:

1. Remove spots or defacement resulting from Work of this Section.

2. Retouch all damaged surfaces to leave Work in perfect finished condition.

3. If spots or defacement cannot be satisfactorily removed and retouched, re-finish the surfaces as directed.

4. Within the three foot work area created for removal and painting where existing paint is known or assumed to be lead-based all objects and surfaces shall be thoroughly HEPA vacuumed, wet-cleaned and HEPA vacuumed again. In rooms where the ceiling has been painted all surfaces and objects in the room shall be cleaned in this manner.

5. The contractor shall ensure that the objects and surfaces under protective covering are free of any dust or debris created during painting activities. If necessary, these objects and surfaces shall be wet cleaned and HEPA vacuumed.

6. The contractor shall conduct any cleaning deemed necessary by the independent environmental consultant.

7. Free all operating units of painted materials and leave them clean and in proper working order.

8. Remove from premises all surplus paint materials, debris and any other rubbish resulting from the Work.

9. Leave storage space clean and in condition required for equivalent spaces in project.

3.6 PROTECTION

A. Provide caution tape and/or locked entryways during paint removal activities in existing buildings to prevent access to the work area from unauthorized personnel.

B. Provide "Wet Paint" signs to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their Work after completion of painting operations.

C. At the completion of Work of other trades, touch-up and restore all damaged or defaced painted surfaces as directed by the RIOC.

3.7 DISPOSAL OF PAINTED WASTE AND DEBRIS FROM EXISTING BUILDINGS

A. Testing

Perform Toxicity Characteristic Leaching Procedure (TCLP) testing of all painted waste and debris generated from existing painted objects and surfaces.

B. Storage and Disposal

Storage and disposal shall be in accordance with Specifications Section S01900 - Existing Premises Work, Article titled "Disposal of Painted Waste and Debris".

END OF SECTION 099000

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SECTION 105000 - TACTILE WARNING SURFACE TILES

PART 1 − GENERAL

1.01 DESCRIPTION

A. This Section includes Specifications for furnishing and installing Cast In Place Replaceable Tactile Warning Surface Tiles (REP) with an in-line truncated dome pattern, embedded in all curb ramps and walking surfaces at the locations and to the dimensions shown on the Drawings, in accordance with the Contract Documents and as directed by the Engineer.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specifications, apply to this Section.

B. Americans with Disabilities Act (ADA) Title 49 CFR Transportation, Part 37.9 Standards for Accessible Transportation Facilities, Appendix A, Section 4.29.2 Detectable Warnings on Walking Surfaces. FHA Memo (5-06-02) titled Truncated Domes. Federal Register Volume 71, No. 209, 49 CFR Part 37 (10-30-06), ADA Standards for Transportation Facilities (11-29-06, DOT): Sections 406, 705, and 810. ADA Standards for Accessible Design – 2010 (9/05/11, DOJ), ADAAG: Sections 705 and 810. Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Rights of Way (7/23/11, Access Board), PROWAG: Sections R208, R304, R305, R308, and R309.

C. American Society for Testing and Materials (ASTM) Test Methods B117, C501, C1028, D543, D570, D638, D695, D790, G151, G155, and E84.

D. American Association of State Highway and Transportation Officials (AASHTO): Test Method AASHTO-H20.

E. California Code of Regulations (CCR 2007) Title 24 Part 1 Articles 2, 3 and 4, and Part 2 Section 205 definition of “Detectable Warning”, Section 1127B.5 for “Curb Ramps”, and Section 1133B.8.5 for “Detectable Warnings at Hazardous Vehicle Areas”. California Department of Transportation Detectable Warning Surface Authorized Material List. Division of the State Architect IR 11B-3 (1/26/05) and IR 11B-4 (1/01/11). IR 11B-4 (1/01/11) removed the requirement for a “staggered” pattern and now calls for the “square grid” (in-line) pattern.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer’s literature describing products, installation procedures and maintenance instructions.

B. Samples for Verification Purposes: Submit two (2) Tactile Warning Surface samples minimum 8” x 8” of the kind proposed for use. Samples shall be properly labeled and shall contain the following information: Name of Project, Submitted by, Date of Submittal, Manufacturer’s Name, and Catalog Number.

C. Shop Drawings: Submit Standard Manufacturer Shop Drawings showing all pertinent characteristics of the composite Cast In Place Replaceable Tactile Warning Surface Tile (REP), including profile, sound on cane contact amplification feature and installation methods.

D. Material Test Reports: Submit current test reports from qualified, accredited independent testing laboratory in accordance with ASTM guidelines and indicating that materials proposed for use are in compliance with specification requirements and meet the properties indicated. All test reports submitted shall be representative of the Cast In Place Replaceable Tactile Warning Surface Tile (REP) delivered to the Project.

E. Maintenance Instructions: Submit copies of manufacturer’s specified maintenance practices for each type of Tactile Warning Surface Tile and accessory.

1.04 QUALITY ASSURANCE

A. Provide composite Cast In Place Replaceable Tactile Warning Surface Tiles (REP) as produced by a single manufacturer with a minimum of five years experience in manufacturing Cast In Place Replaceable Tactile Warning Surface Tiles (REP).

B. Installer’s Qualifications: Engage an experienced installer certified in writing by the Tactile Warning Surface manufacturer, who has successfully completed Tactile Warning Surface installations similar in material, design, and extent to that indicated for the Contract.

C. Cast In Place Replaceable Tactile Warning Surface Tiles (REP) must be compliant with ADAAG, PROWAG, and CA Title 24 requirements. Division of the State Architect IR 11B-3 (1/26/05) and IR 11B-4 (1/01/11). IR 11B-4 (1/01/11) removed the requirement for a “staggered” pattern and now calls for the “square grid” (in-line) pattern.

D. Cast In Place Replaceable Tactile Warning Surface Tiles (REP) shall meet or exceed the following test criteria using the most current test methods:

1. Compressive Strength: 28,900 psi minimum, when tested in accordance with ASTM D695.
2. Flexural Strength: 29,300 psi minimum, when tested in accordance with ASTM D790.

3. Water Absorption: Not to exceed 0.10%, when tested in accordance with ASTM-D570.
4. Slip Resistance: 1.05 minimum wet and 1.18 dry static coefficient of friction when tested in accordance with ASTM C1028.
5. Flame Spread: 25 maximum, when tested in accordance with ASTM E84.
6. Salt and Spray Performance of Tactile Warning Surface: No deterioration or other defects after 200 hours of exposure, when tested in accordance with ASTM-B117.
7. Chemical Stain Resistance: No reaction to 1% hydrochloric acid, motor oil, calcium chloride, gum, soap solution, bleach, and antifreeze, when tested in accordance with ASTM D543.
8. Abrasion Resistance: 500 minimum, when tested in accordance with ASTM C501.
9. Accelerated Weathering of Tactile Warning Surface when tested by ASTM-G155 or ASTM G151 shall exhibit the following result: $\Delta E<5.0$ at 2,000 hours minimum exposure.
10. Tensile Strength: 11,000 psi minimum, when tested in accordance with ASTM D638.
11. AASHTO-H20 Load Bearing Test: No Damage at 16,000# loading.
12. Freeze/Thaw/Heat: No deterioration when tested in accordance with ASTM C 1026.

1.05 DELIVERY, STORAGE AND HANDLING

A. Cast In Place Replaceable Tactile Warning Surface Tiles (REP) shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy wrappings.

B. Storage Facility
1. Store REP Tiles in an area that is within an acceptable temperature range (40-90 degrees). In particular, protect sealants from freezing.
2. Maintain Storage Facility in a clean dry condition to prevent contamination or damage to REP Tiles and incidentals.

1.06 GUARANTEE

A. REP Tiles shall be guaranteed in writing for a period of five (5) years from date of Contract's final completion. The guarantee includes manufacturing defects, breakage, and deformation.

PART 2 − PRODUCTS

2.01 MATERIALS

A. Composition: REP Tiles shall be manufactured using a matte finish exterior grade homogeneous (uniform color throughout thickness of product) glass and carbon reinforced polyester based Sheet Molding Compound (SMC) composite material. Truncated domes must contain fiberglass reinforcement within the

truncated dome for superior structural integrity and impact resistance. A matte finish will be required on the Tactile Warning Surface for superior slip resistance performance superior to that offered by a gloss finish. Use of Tactile Warning Surface Products employing coatings or featuring layers of material with differing composition, performance, or color properties is expressly prohibited under this Section.

B. Color: Color shall be homogeneous throughout REP Tile.

1. Federal Yellow (Y) per Federal Standard 595B Table IV, Color No. 33538.
2. Brick Red (R) per Federal Standard 595B Table IV, Color No. 20109.
3. Clay Red (CR) per Federal Standard 595B Table IV, Color No. 22144.
4. Safety Red (SR) per Federal Standard 595B, Table IV, Color No. 31350.
5. Black (B) per Federal Standard 595B Table IV, Color No. 37038.
6. Dark Gray (G) per Federal Standard 595B Table IV, Color No. 36118.
7. Safety Blue (B) per Federal Standard 595B Table IV, Color No. 15187.
8. White (W) per Federal Standard 595B Table IV, Color No 37925.
9. Seattle Yellow (SY) per Federal Standard 595B Table IV, Color No. 23594.
10. Houston Beige (Pantone #7529C).

C. Domes: Square grid pattern of raised truncated domes of 0.2”nominal height, base diameter of 0.9” and top diameter of 0.45”. The Federal Code of Regulations permits a truncated dome spacing range of 1.6”-2.4.” For superior wheelchair, walker and shopping cart mobility, the preferred truncated dome spacing shall have a center-to-center (horizontally and vertically) spacing of 2.35”, measured between the most adjacent domes on square grid.

D. Configuration: REP Tile sizes shall be as indicated on the Contract Drawings. The REP Tiles shall feature a minimum of eight (8) embedded corrosion resistant 1 ½” corrosion resistant concrete inserts with ½” x 1 ½” heavy duty steel bolts and washers. Bolts must be covered with a structural water tight cap. Bolts must be located BETWEEN the truncated domes (in the field) for maximum protection of the Bolt integrity. Bolts are NOT to be located in the truncated dome.

1. The field area shall consist of a non-slip textured surface with a minimum static coefficient of friction of 0.80, wet and dry.
2. At a minimum, REP Tile thickness shall measure ¼” nominal exclusive of the perimeter minimum 3/8” thick (nominal) by 1” wide flange. The body of the Tactile Warning Surface Tile must consist of a SOLID body for maximum strength and to eliminate the possibility of air entrapment and cracking.

E. Truncated Dome Surface of REP Tile shall be protected with factory installed plastic sheeting for cleanliness during the installation process. Basic Installation Guidelines shall be printed on the plastic sheeting in both English and Spanish for customer convenience.

F. Dimensions: REP Tiles shall be held within the following dimensions and tolerances:
   1. Length and Width: As shown on drawings
   2. 2.35” Dome Spacing: [24”x36”]

G. The Specifications of the concrete, sealants and related materials shall be in accordance with the Contract Documents and the guidelines set by their respective manufacturers.

2.02 MANUFACTURERS

A. Available manufacturers, subject to compliance with these Specifications include, but are not limited to, the following:

   1. ADA Solutions Inc. of Chelmsford, MA (Phone: 800-372-0519, Fax: 978-262-9125, Web Site: www.adatile.com , E: info@adatile.com), or approved equal.
   2. Requests for Approved Equal Status must be submitted and approved by the Owner during the Bid Phase of the Project.

2.03 EQUIPMENT

A. Contractor shall provide all tools, equipment and services required for satisfactory installation per manufacturer’s instruction as Incidental Work. Equipment, which may be required include typical mason’s tools, a 2-foot long level with electronic slope readout, (2) 25-pound weights, and a rubber mallet with a piece of wood for tamping down the Tactile Warning Unit(s).

PART 3 − EXECUTION

3.01 PREPARATION

A. During all concrete pouring and REP Tile Installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.

B. The physical characteristics of the concrete shall be consistent with the Contract Specifications while maintaining a slump range of 4 - 7 to permit solid placement of the REP Tile. An overly wet mix will cause the REP Tile to float. Under these conditions suitable weights such as 2 concrete blocks or sandbags (25 pounds) shall be placed on each REP Tile.

C. The concrete shall be poured and finished, true and smooth to the required dimensions and slope prior to REP Tile placement.

3.02 INSTALLATION

A. Contractor will not be allowed to install Tactile Warning Surface Tiles until all submittals have been reviewed and approved by the Engineer.

B. REP Tile shall be installed per manufacturer's instructions.

C. To the maximum extent possible, the REP Tiles shall be oriented such that the rows of in-line truncated domes are parallel with the direction of the ramp. When multiple REP Tiles regardless of size are used, the truncated domes shall be aligned between the tactile warning surface tiles and throughout the entire tactile warning surface installation.

D. In accordance with the Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Rights of Way (7/23/11, Access Board): Sections 304 + 305), Tactile Warning Surface Tile shall be located relative to the curb line as shown within Sections 304+305 of the Guidelines.

E. The REP Tiles shall be tamped or vibrated into the fresh concrete to ensure that there are no voids or air pockets, and the field level of the Tactile Warning Surface Tile is flush to the adjacent concrete surface or as the Drawings indicate to permit proper water drainage and eliminate tripping hazards between adjacent finishes.

F. On Continuous Runs: The Installer shall leave a 1/8" nominal gap between successive Tactile Warning Surface Tiles. As part of the concrete finishing operation, the Installer shall apply ¼" edge treatment around the perimeter of the Tactile Warning Surface Tiles to facilitate future replacement of the Tactile Warning Surface Tile. A Urethane Sealant such as Sikaflex 1a or BASF NP1 shall be applied to the edge treatment for a watertight Tactile Warning Surface Tile installation.

3.03 CLEANING AND PROTECTING

A. Protect REP Tiles against damage during construction period to comply with REP Tiles manufacturer's Specifications.

B. During and after the REP Tile installation and the concrete curing stage, it is imperative that there are no walking, leaning or external forces placed on the REP Tile to rock the REP Tile, causing a void between the underside of the REP Tile and the concrete substrate.

C. Remove Protective Plastic Sheeting from REP Tile within 24 hours of installation of the REP Tile. Particularly under hot weather conditions (80 degrees or higher), plastic sheeting will adhere strongly (resulting in difficult removal of same) to Tactile Warning Surface Tile when not removed quickly.

D. If requested by the Project Manager, clean REP Tiles not more than four (4) days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project. Clean REP Tile by method specified by Tactile Warning Surface Products manufacturer.

END OF SECTION

SECTION 108113 – BIRD CONTROL DEVICES

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION:

A. Bird Barrier Strip Models: a physical barrier system constructed of stainless steel strip and wire to prevent pest birds and climbing animals from landing, roosting, nesting or climbing on architectural surfaces.

B. Mounting Hardware: mounting clips and fasteners designed to securely fasten the Bird Control to architectural surfaces. Hardware is made of stainless steel or non-corrosive materials.

C. Surface Cleaning System: surface disinfectants and deodorizers to neutralize potentially hazardous bird or animal waste and prepare surface for installation.

1.2 QUALITY ASSURANCE

A. Installer must obtain, review and understand manufacturer planning guides, estimating worksheets and installation instructions.

B. Installer must be completely familiar with the proper installation procedures for the Bird Barrier Strip Models specified.

C. Installer must be completely familiar with the specified mounting hardware and mounting hardware installation procedures.

D. MUST BE MADE U.S.A.

1.3 SUBMITTALS

A. Literature including: planning guide, completed estimate worksheets and installation instructions for the specified model and mounting hardware.

B. Sample of specified model - not less than 2” (5.1cm) in length.

C. Sample of model in the specified color.

D. Sample of specified mounting hardware.

E. Installation instructions and drawings from manufacturer

1.4 STORAGE & HANDLING

A. Provide storage to keep shipping boxes dry, clean and undamaged. Do not stack or place other packaging on the shipping boxes.

B. Keep Bird Control Strips and Mounting Hardware in original packaging until needed for installation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

A. Nixalite of America Inc
1025 16th Avenue, PO Box 727, Dept. NI, East Moline, Illinois 61244; U.S.A.
Ph: 800.624.1189 or 309.755.8771 - Fax: 800.624.1196 or 309.755.0077
E-mail: birdcontrol@nixalite.com or planning@nixalite.com
Web: www.nixalite.com.

B. Nixalite Premium Barriers Model “S” or approved equal

2.2 BIRD BARRIER STRIPS

A. Barriers: are all stainless steel wire and strip barriers.
Wires: High grade stainless steel, 0.041” (1mm) diameter, full-hard spring temper.
Base Strip: High grade stainless steel, 0.25” wide x 0.02” thick (6.3mm x 0.5mm), full anneal for flexibility, easy strip cutting and surface shape memory.

B. Strip Lengths: 48” (122.0cm) strip lengths.

C. Model: 4” high (10.2cm), 4” wide (10.2cm) NO LESS THAN 120 wire points per foot. Full 180-degree wire coverage. For all bird species on all types of surfaces. Use with Nixalite Model W for climbing animal barrier installations.

G. Finish: Natural stainless steel finish or manufacturers ColorCoat finish.

H. ColorCoat: standard colors are black, white, gray, tan, brown, bronze, green and red. Choose standard color that best suits application. For custom color: installer must supply manufacturer with color sample not less than 2" (5.1 cm) square.

2.3 MOUNTING HARDWARE

A. To be made of stainless steel or non-corrosive materials. Standard mounting hardware supplied with Bird Barrier Models in set quantities. Hardware to allow for strip removal and reinstallation without causing damage to the installation surface, the strips or mounting system.

B. Specify the mounting hardware that best suits the installation surface. All hardware listed is made of either stainless steel or non-corrosive materials.

Installation Surface	Mounting Hardware Unit
Steel, cast iron, brass, bronze;	Mounting clip, drive screw, washer
Pipes, cables, conduit, grates;	Wire tie, wire tying tool, adhesive

C. Optional Fastening:

Custom Forms:
Use custom made stainless steel form, bracket or strap to fasten bird control strips to difficult surface with limited or zero surface penetration requirements. *Contact manufacturer for custom form design*.

2.4 SURFACE CLEANING SYSTEM

A. Steri-Fab: surface disinfectant and bactericide to neutralize bird waste. Multipurpose sanitizing spray used to quickly kill disease causing bacteria, parasites, fungi, insects, etc. Non-residual product, Steri-Fab is inert after it dries. Do not use with Microcide-SQ on the same surface.

B. Microcide-SQ: broad spectrum disinfectant, cleaner and deodorizer used to sanitize hard surfaces as well as fabrics and clothing. Use to kill a wide spectrum of organisms and disease causing bacteria. Do not use with Steri-Fab on the same surface.

C. Microsan: anti-bacterial personal protection products to help prevent disease transmittal before, during and after working on and around surfaces contaminated with bird and animal wastes. Use to compliment personal protection equipment standards (PPE).

PART 3 - EXECUTION

3.1 INSPECTION

A. Visually inspect all installation surfaces. Make sure all surfaces are clean, dry and free from debris or other conditions that could impede the workflow of this section.

B. Notify architect of detrimental conditions. Do not proceed until these conditions have been corrected.

3.2 PREPARATION

A. Field Measurements: Verify dimensions of each installation surface. Use manufacturer's Planning Guidelines and Estimate Worksheet to make sure you have sufficient quantity of bird control to properly protect the specified surfaces.

B. Make sure all installation surface finishing requirements have been accomplished before installing Bird Control Models. Bird Control to be last item installed on specified surfaces. DO NOT apply any surface coating or treatment (paint, sealer, etc.) over the installed Bird Control Models or mounting hardware.

C. Remove or relocate all plants or foliage that overhangs the installation surfaces.

3.3 SURFACE CLEANING

A. All surfaces to be clean, dry and free of obstructions before bird control is installed.

B. IF BIRD WASTE IS PRESENT:
Treat, neutralize and safely remove all bird waste from installation surfaces. Installer must follow all city, state and federal regulations regarding the proper removal and disposal of bird droppings.

C. Use surface cleaning products to neutralize any bird droppings, nests and related waste materials that may be present. Allow all surfaces to air dry completely, and then reapply to sanitize and deodorize the surface before proceeding. Strictly follow treatment instructions provided with surface cleaning products.

D. Use anti-bacterial personal protection products to help prevent disease transmittal when working around surfaces contaminated with bird droppings.

3.4 INSTALLATION

A. Install specified Models in strict accordance with manufacturer's strip spacing and installation guidelines. Protect all surfaces.

B. Protect the entire surface, not just the outside edges. NO GAPS allowed in the Bird Barrier Strip coverage. Cut strips where necessary to fit the surface properly.

C. Wires of Models to extend over outside edge of surface by at least 1/4" (0.6cm). Model base strips to extend over any open end of surface by at least 1/2" (1.2cm).

D. Fasten Models to the surface with the mounting hardware recommended by the manufacturer. Follow hardware spacing guidelines and installation procedures supplied by manufacturer.

3.5 ADJUSTMENTS / CLEANING

A. Remove debris and waste materials from project site.

B. Inspect finished installation. Make any adjustments needed to conform to Nixalite's spacing and installation guidelines.

End of Section

SECTION 142000 - ELECTRIC ELEVATORS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The "General Conditions of the Contract for Construction" of the American Institute of Architects Abbreviated Form of Agreement Between Owner and Contractor, AIA Document A107, Latest edition shall form a part of this specification except as otherwise herein provided.

1.2 DESCRIPTION

A. Include all labor, materials and appliances required for the furnishing, installing, and testing, complete and ready for operation in a manner satisfactory to the Architect, all the work shown on the drawings and specified herein.

1. Two (2), non-proprietary electric geared traction, passenger elevators, City No. T.B.D, as indicated on the drawings and specified herein.

2. Glass Car enclosures, including floor covering and car doors, hangers and operating devices for car doors and landing doors.

3. Hatchway entrances complete, including doors, hangers, hanger cover plates, headers, angle struts, bucks, saddles, saddle supports and fascias.

4. Car and counterweight guide rails, complete.

5. Signals and trail cables for signals and intercommunication system.

6. All controls and signal equipment.

7. Communications system.

1.3 WORK NOT INCLUDED IN THIS SECTION

A. The following work related to the work of this Section is specified in other Sections of the Specifications:

1. Hatchway enclosures, pits and machine rooms.

2. Smoke holes venting the elevator shafts.

3. Supports for hoisting machines and sheave beams, car and counterweight buffers, controllers, safety governors, etc..

4. Fixed vertical pit ladders.

5. Feeders with main line switches, circuit breakers or fuses in elevator machine rooms and auxiliary feeds to panels as required.

6. Hatchway outlets for car lights and signal outlets in elevator machine room.

7. Elevator machine room and pit lights.

8. Suitable storage space for tools and materials brought into the buildings by the Elevator Contractor to be used during construction.

9. Finish painting, except as otherwise specified.

10. Electric power for testing the elevator equipment.

1.4 INTENT OF SPECIFICATION AND DRAWINGS

A. The entire installation shall be installed as shown on drawings and/or as herein specified.

B. The type, duty, etc., of each elevator shall be in accordance with the data given on the drawings and/or hereinafter specified.

C. Wherever in these specifications the words "supply", "provide", "furnish" or similar term is used in the sense of furnishing apparatus or materials, it shall mean that the Contractor for this work shall supply, install and connect such apparatus or materials to which it is referred, except as may otherwise be specifically defined.

D. Bring to the attention of the Architect immediately any changes in the size or location of the material or equipment which may be necessary in order to meet field conditions, or in order to avoid conflict with the equipment of other Sections. Obtain the Architect's acceptance before such deviations are made.

E. It is the intent of these specifications to provide a complete system, and all necessary labor and materials, whether or not specifically shown on the drawings or mentioned herein, shall be included and left in good working order, ready for operation.

F. Locate all equipment and accessories in such a manner as to provide easy access for proper service and maintenance.

G. Changes in construction required to accommodate installation of equipment of the Contractor performing the work in this Section, from conditions shown on the Contract Drawings and/or specified, shall be at the expense of the Elevator Contractor and may be made only upon acceptance of the Architect.

1.5 RELATIONS WITH OTHER TRADES

A. Confer with others engaged in the construction of the building whose work might affect the installation, and arrange all parts of the work and equipment in proper relation to the work and equipment of others, with the building construction and with the architectural finish, so that it will harmonize in service and appearance. Special care shall be taken in the installation of the equipment, where same is concealed, to assure that it does not project beyond the finished lines of floors, ceilings or walls.

B. Any part of the work specified to be furnished complete under this Section but such work is required to be furnished and erected by mechanics other than those directly employed under this Section, sublet the work or engage such special mechanics to do it. Be responsible for the workmanship, equipment and performance of all such work sublet by him.

C. If it should be necessary to remove and relocate any material or equipment that has been installed without the proper investigations and coordination with the work of other Sections, such materials or equipment shall be removed and relocated by this Contractor without any additional cost to the Owner.

1.6 PROGRESS SCHEDULE

A. Within six (6) weeks after the Contract has been awarded to the Contractor and he has been notified to proceed with his contract, the Contractor shall prepare and submit to the Owner a Progress Schedule setting forth the time at which the different branches of the work will be started and completed.

1.7 CHASES, CUTTING AND PATCHING

A. Provide and place required sleeves, forms and inserts before walls, partitions, floors or roofs are built. The cost of cutting and patching of walls, partitions, ceilings and floors necessary for reception of work caused by failure to provide or properly locate sleeves, forms and inserts, or caused by incorrect location of work shall be borne under this Section.

B. When it becomes necessary to cut finished materials, submit drawings showing the work required to the Architect for acceptance, and obtain acceptance before doing such cutting.

C. Chases and openings in walls will be provided under the work of other Sections. Furnish exact dimensions and locations of these openings to suit the apparatus to be used before such walls are built.

D. No cutting or altering the work of other Sections will be permitted without the consent of the Architect.

1.8 STANDARDS

A. Materials specified by reference to a specific standard such as the American Society of Testing Materials, Underwriters' Laboratories, American National Standards Institute, Federal Specifications, a trade association standard, or other similar standard shall

comply with the requirement in the latest revision thereof, in effect at the time of bidding, except as limited by type, class or grade, or modified in such reference.

1.9 DEFINITIONS

A. All terms in the specifications have the definition given in the Safety Code for Elevators, Escalators and Dumbwaiters as approved by the American National Standard Institute, latest edition, including all revisions and changes authorized by the Sectional Committee on Elevator Safety Code to date of these specifications. Hereafter in these specifications, the abbreviation "ANSI Code" shall be understood to refer to this Code.

1.10 NOTICE TO BIDDERS

A. Before submitting proposals, examine the specifications and all drawings relating to the work and become fully informed as to the extent and character of the work and the relation of the work to the work of other Sections. Examine the drawings of other Sections to become familiar with all the problems and details of the building construction and to note conditions which affect the work.

1.11 SIGNS AND ADVERTISEMENTS

A. No signs and advertisements will be allowed to be displayed on the premises.

1.12 SPECIAL TREATMENTS

A. The Owner will accept no exposed fasteners and no manufacturers' logos or trademarks on any material or equipment provided in these specifications.

1.13 DESCRIPTION OF ELEVATOR SYSTEMS

A. Passenger Elevators

Quantity	Two (2) single wrap overhead geared traction passenger elevators (1:1 roping).
Capacity	2500 pounds.
Speed	100 feet per minute.
Travel	Approximately 14'-0".
Number of Landings	Two (2) landings.
Number of Openings	Two (2), Center openings, in line, each elevator.
Operation	Duplex Collective.

Special Operations	Fireman's Emergency Service.
Control	V.V.V.F..
Safety	Instantaneous.
Buffers	Spring
Car Enclosure	Glass enclosure, as indicated on the drawings and specified herein.
Landing Doors	Center Opening, 3'-6" wide.
Door Operation	Medium speed power with electronic door control.
Signals	Call acknowledging lights, car and hall position indicators, car travel lanterns.
Machine Location	Overhead on beams.
Communication Equipment	Hands-Free & intercom communication systems.
Power Supply	208 volts, 3 phase, 60 hertz.

1.14 SHOP AND ERECTION DRAWINGS AND SAMPLES

A. Submit required or requested shop and erection drawings, and obtain written acceptance of same before ordering or installing any equipment or materials.

B. Shop drawings of equipment shall consist of manufacturer's scale drawings, cuts or catalogs, including descriptive literature which shall indicate the construction, including material and physical dimensions, and complete operating data.

C. Erection drawings shall consist of scale drawings of the work, including foundations in plan and elevation. These drawings shall show clearances between units and relation of equipment to space assigned. Make erection drawings when requested by the Architect to supplement his diagrammatic drawings.

D. Submit for acceptance samples requested. The samples shall be properly tagged and shall remain in the Architect's possession until final acceptance of the work.

1.15 WIRING DIAGRAMS

A. The Contractor shall furnish a complete set of wiring diagrams for the elevators, showing the electrical connections, functions and sequence of operation of all

apparatus connected with the work; and all data and instructions necessary for the proper maintenance and repair of all equipment. All items that do not apply directly to this installation shall be omitted from the final diagrams, and these diagrams should reflect all field and/or shop changes. The diagram shall be kept in the elevator machine room.

B. Provide two (2) additional sets of wiring diagrams for the Owners records.

1.16 LAWS AND ORDINANCES

A. All local and State laws and regulations, Occupational Safety and Health Administration Rules, and National Fire Protection Association's recommendations, governing or relating to any portion of this work are hereby made a part of these specifications; responsibility for compliance to their provisions is included.

B. Inform the Architect of any work or materials which violates any of the applicable laws and regulations before proceeding with the work.

1.17 APPLICABLE CODES AND SPECIFICATIONS

A. Only the latest editions and revisions of referenced codes ASME A17.1 – 2000 with supplements A17.1a – 2002 and A17.1b – 2003 modified by the NYC-Appendix K code and specifications shall be applicable for the work of this Section.

B. All construction, workmanship and materials, all factors of safety used in designing all structural and working parts of the equipment, and unless herein specifically modified or otherwise shown on the drawings, all top and bottom clearances and the construction and operation of all safety devices shall be in full accordance with the requirements of ANSI Code. In addition, all such equipment and clearances shall fulfill the rules, regulations and codes of all local bodies having jurisdiction.

C. Where the requirements of the ANSI Code are more severe than local rules, regulations and codes, the ANSI Code shall govern.

D. Factors of safety, buffers, roping and rope socketing, guide rails, safeties, speed governors, counterweights, top and bottom terminals stopping devices, emergency stopping devices, etc., are not described hereinafter, except as to special requirements, since they are fully covered in the ANSI Code.

E. In addition, the equipment shall conform to certain special safety requirements as given in these specifications.

1.18 DELIVERY OF MATERIALS AND EQUIPMENT

A. Store materials and equipment where directed by the Architect. Any damage caused by any overloading of the structure shall be repaired at no additional cost to the Owner. Include the hoisting of all materials and equipment and assume all responsibility for such hoisting equipment.

1.19 ACCESS OPENINGS

A. The bidder shall examine the Architect's drawings and shall notify the Architect if any access opening or gratings are required for apparatus furnished under these specifications, in addition to those shown on the Architect's drawings.

B. In the event of failure to do this at the time of bidding, this Contractor shall furnish such access openings or gratings at his own expense. Access openings shall be of a character satisfactory to the Architect.

1.20 DAMAGE TO PROPERTY

A. Restore to its original condition without extra payment any of the Owner's property that shall become damaged due to the negligence of any employees or agents of the Contractors. Such repairs shall meet the acceptance of the Architect.

B. Take proper care and protect all portions of the work until its acceptance. Any and all portions of work liable to damage under this or other Sections or by freezing or inclement weather must be thoroughly and securely protected by a substantial boarding or covering until not further required. It shall be removed from the premises only when its removal is directed by the Architect.

C. Protect all plated and polished material and trimming against damage.

1.21 SHUT DOWNS

A. When installation of new work requires the shutdown of an existing operating system, the connection of the new work shall be performed only after not less than 72 hour notification to, and acceptance by the Owner.

1.22 GUARANTEES

A. The Contractor shall furnish, under his contract, a written guarantee to replace or repair promptly at his own expense, any workmanship and equipment in which defects develop within "one year from the date of final acceptance of his work", evidenced by the date of final payment. The work shall be done as directed by the Architect. This guarantee shall also provide that where defects occur, the Contractor will assume responsibility for all expenses incurred in repairing and replacing work of other trades affected by defects, repairs or replacements in equipment supplied by the Contractor.

1.23 MAINTENANCE

A. Provide for a period of twelve (12) months after completion and acceptance of all equipment," a free service period and full maintenance of the equipment". This maintenance shall include systematic examinations and adjustments and lubrication of all elevator equipment. The Contractor shall also repair or replace electrical and mechanical parts of the equipment whenever this is required and shall use only genuine standard parts produced by the manufacturer of the

equipment concerned. (All wire ropes shall be replaced as often as necessary to maintain an adequate factor of safety.) Renewals or repairs necessitated by reason of negligence of misuse of the equipment or by reason of any other cause beyond the control of the Contractor or his supplier, except ordinary wear and tear, shall not be the responsibility of the Contractor.

B. All work under this maintenance provision shall be performed by competent personnel under the supervision and in the direct employ of the Contractor. Work shall be done during the Contractor's regular work day.

1.24 PROPOSALS FOR SERVICE CONTRACT

A. Requirements under Service Contract:

1. Term: Two (2) years, becoming effective at the termination of free service period and the guarantee period, as hereinbefore specified.

2. Service shall include regular examinations of the installation by competent and trained employees of the Elevator Contractor; and shall include all necessary adjustments, greasing, oiling, cleaning, supplies and replacement of parts required to keep the equipment in perfect operation.

3. Maintenance service shall be performed during the normal working days and hours of the Elevator Contractor and shall include, 24 hour, seven-day a week call back.

4. An annual adjustment in the cost of the Service Contract shall be made at the end of each year the contract is in effect. Adjustments shall be for the cost of labor and material only. Adjustment for labor shall be based upon the percentage of increase or decrease in the straight hourly rate, plus fringe benefits paid to employees of the Contractor performing the Service Work. Adjustment for materials shall be based upon the percentage of increase or decrease shown by the index of "Wholesale Commodity Prices for Metal and Metal Products" published by the U. S. Department of Labor, Bureau of Statistics.

5. The service contract shall include the required Category 1 & Category 5 tests.

PART 2 - EQUIPMENT

2.1 ACCEPTED MATERIALS, NON-PROPRIETARY

A. Materials and equipment shall be new, of makes and kinds specified herein, or as indicated on the drawings, without exception. Where one brand, make of material, device or equipment is specified or shown, the products of the manufacturers listed in "ACCEPTED MANUFACTURERS" shall be regarded as acceptable.

B. Should a bidder desire to install equipment and materials other than those included under "ACCEPTED MATERIALS" he shall submit with his bid a rider listing the deductions or additions to the Contract for these substitutions. Said substitutions must be accepted in writing by the Architect, otherwise all materials and equipment must be according to plans and specifications.

2.2 ACCEPTED MANUFACTURERS

A. All materials shall be in strict accordance with the quality, style, performance and sizes hereinbefore specified. Manufacturer's names and catalog numbers are given in the specifications for the purpose of establishing a standard of quality, style, size and type and shall not be construed to exclude equipment or material of other manufacturers.

B. To furnish equipment of a manufacturer other than that specified or listed hereinafter, include a complete specification of the substituted item along with each submission copy of shop drawings. Write specifications as close as possible over the Contract Specifications; each paragraph shall bear the same paragraph number as the Contract Specifications so that close comparison can be made with the equipment specified. Changes shall be subject to the complete acceptance of the Architect.

C. When materials and equipment are purchased from the manufacturer specified or listed hereinafter, submit a complete verification specification with each copy of shop drawings.

1. ROLLER GUIDES

a. Elevator Safety Company, ESCO

2. STEEL ROPES

a. AFD Industries Inc.
b. Bethlehem Elevator International
c. Macwhyte Wire Rope Company
d. United Ropeworks

3. GOVERNOR

a. Hollister Whitney Elevator Corporation

4. WIRING

a. Benfield Electric Corp.
b. Draka Elevator Products

5. HOISTING MACHINE

a. Hollister-Whitney Elevator Corporation
b. Titan Machine Corporation

6. AC HOIST MOTORS

a. LeRoy Somer Inc.
b. Imperial
c. General Electric
d. Reuland

7. CONTROLLERS

a. G.A.L. Galaxy
b. Elevator Controls
c. Smartrise Engineering

8. LEVELING DEVICE

a. G.A.L. Galaxy
b. Claddagh Electronics
c. Smartrise Engineering

9. SIGNAL FIXTURES

a. Monitor Controls
b. G.A.L.
c. Innovation Industries

10. HANGERS AND TRACKS

a. G.A.L.

11. DOOR OPERATORS

a. G.A.L.

12. CAB ENCLOSURES

a. ECI-EDI
b. National Cab & Door

13. ENTRANCES

a. ECI-EDI
b. National Cab & Door

14. ASCENDING CAR DEVICE/ROPE GRIPPER

a. Hollister-Whitney Elevator Corporation

2.3 MACHINE SUPPORTS

A. Provide all machine beams, channels, angles, zee bars and steel plates required for the elevator machines, secondary sheaves, deflector sheaves, motor generator sets SCR units, controllers, selectors, etc., also all channels, angles and plates for the supports of the governors.

B. Provide the necessary bolts, nuts, washers, steel for the proper installation of the compensating tie-down sheaves, etc., as may be required.

C. The machines shall be carefully aligned and centered with reference to the car and counterweight rope hitch centers and then securely bolted and braced to prevent shifting.

2.4 HOISTING MACHINES AND CONTROL, NON-PROPRIETARY

A. Provide for each Elevator the following:

1. The hoisting machine shall be of the single worm geared traction type, with motor, brake, gearing and driving sheaves mounted in proper alignment on a cast iron or steel bedplate. The worm shall be of steel, integral with the worm shaft, and shall be provided with a ball bearing thrust with self-aligning blocks, or shall be of the preloaded type thrust bearing, designed to take the end thrust of the worm in both directions. Thrusts shall be removable without dismantling machine. The worm gear shall be hobbed from a bronze rim which shall be accurately fitted and bolted to the gear spider.

2. Bearings of anti-friction metal or roller bearings shall be provided and equipped with suitable means for lubrication. Brake shall be spring applied, electrically released and designed to be instantly and automatically applied in event of interruption of power supply from any cause.

3. Sheaves shall be made of semi-steel containing approximately 25% steel, accurately turned with machine progressive grooves, shaped so as to maintain traction throughout the life of the groove. Brake wheels shall be accurately turned and balanced. surface of sheaves and brake wheels shall show a hardness of not less than 240 Brinnell.

4. The diameter of the hoisting machine driving sheaves shall be not less than forty-eight (48) times the diameter of the hoisting rope.

B. Geared Elevator Hoisting Machine Motor AC

Provide new hoist motors for all machines complying with the following:

1. The motor shall be of the alternating current reversible induction type of a design adapted to the severe requirements of elevator service. Motor shall be capable of developing the required high starting torque (minimum 225%) with a low starting current, and shall be designed to stand the severe loads encountered in elevator service.

2. The motor shall be rated in accordance with the standards of NEMA, NFPA and AIEEE 30 minute rating motors, in accordance with the class of insulation of motors, and shall be sufficient capacity to operate elevator with rated contract load at rated contract speed without overheating. The motor will be tested as specified in this Specification.

3. The motor shall be single speed AC and have variable frequency control and shall be of the special elevator type with high internal resistance squirrel cage rotor.

4. Insulation of all windings shall be impregnated and baked to prevent absorption of moisture and oil. The insulation resistance between motor frame and windings shall not be less than one Megohm. The motor windings shall stand a dielectric test of twice the normal voltage plus 1000 RMS volts of 60 Hertz, alternating current for one minute. Insulation shall be Class B. Better insulation may be used but must be approved by the RIOC prior to use. Motors shall be designed to maintain proper temperature during operation.

5. Motor bearings shall be either approved sealed bearing, the antifriction bearing metal sleeve type, or of the open (non-seal) type or roller type arranged for greased lubrication and fitted with grease gun connections and drain plugs. Bearings and lubricant reservoirs shall be virtually dust tight and shall incorporate effective lubricant seals or other means to prevent lubricant leakage. Bearing shall be replaceable type and separate from the motor housing (not part of the housing). Bearings that are part of the motor housing will not be accepted.

6. The design of frames, and end bells, etc., shall be such as to insure perfect alignment of bearings and minimize vibration. The Contractor shall stamp (with approved tool) “date of installation”, on the motor frame and specify the date the motor is installed. The Contractor shall be responsible for providing the RIOC inspector concerned, with a list of dates that the motors were installed, including the motor serial numbers.

7. The Contractor shall provide temperature sensitive electrical resistors (Thermistors) to protect the rotor and stator windings of each elevator hoist motor. Thermistors shall be installed in each phase of each winding and shall have a temperature response setting equivalent to the rating per class of insulation. These Thermistors shall be connected to a motor protection device located on the elevator control panel. When activated, it shall cause the elevator to level in at the nearest floor landing and shall disconnect power from the elevator hoist motor. Activation of the motor protection

device due to thermal overloading, shall require a “manual reset”. In the event of a power outage, the equipment shall be arranged, so that once the normal supply has been re-established, the elevator will automatically reset. The motor protection device shall be clearly labeled and identified at the terminals and a cover plate shall be provided with a light illumination indicating that this device has been tripped with a reset button provided to restore normal operation.

8. Thermistors and method of connecting to motor protection device on the elevator control panel, must be shown on the wiring program.

2.5 ASCENDING CAR DEVICE/ROPE GRIPPER

A. Provide each elevator with an ascending car device/rope gripper.

B. Provide all necessary steel beams, bolts, nuts, washers, etc. to mount device to the machine room floor/beams, as recommended by the manufacturer.

2.6 DEFLECTOR SHEAVES

A. Provide hoist rope deflector sheaves of proper diameter supported by heavy brackets and shafts made as a part of the elevator machine or securely fastened to the floor framing beam.

2.7 CONTROLLERS, NON-PROPRIETARY

A. Provide each elevator with a solid state V.V.V.F. microprocessor controller as follows:

1. Frame: All controller printed circuit boards, discrete components, switches, and other items of control equipment shall be mounted on a common panel or individual panels which are made of an approved moisture-resisting, non-combustible material which shall be securely mounted on a substantial, self-supporting steel frame with fastenings suitable for panel demounting. A vibration-absorbing mounting shall be provided for the steel frame if necessary to eliminate perceptible vibration.

2. Electro-mechanical switches and relays shall be used where heavy current is supplied and/or on safety circuits where required by Code.

3. Switch Design: Switches shall be of the direct-current type, magnet operated with contacts of design and material to insure maximum conductivity, long life and reliable operation without overheating or excessive wear and provide a wiping action to prevent sticking due to fusion. Switches carrying highly inductive currents shall be provided with arc deflectors or suppressors.

4. Switch Mounting: All switches, printed circuit boards, and discrete components shall be mounted on the front of panels together with any

small electronic components, but large capacity resistors shall be mounted on the rear or top of panels. They shall all be readily accessible and easily renewable.

5. Time Delay Device Design: Where time delay circuits are employed, they shall be of an accepted design that is reliable and consistent, such as electronic timing circuits. No air dash pot time relays shall be used.

6. Wiring: Wiring on the controller, whether factory or field wiring, shall be done in neat workmanlike order and all connections shall be made to studs and/or terminals by means of grommets, solderless lugs or similar connections. All wiring shall be copper.

7. Terminal Blocks: Terminal blocks with identifying studs shall be provided on controller for connection of board wiring and external wiring.

8. Marking: Identifying symbols or letters shall be permanently marked on or adjacent to each device on the controller and the marking shall be identical to marking used on the wiring diagrams. In addition to the identifying marks, the ampere rating shall be marked adjacent to all fuse holders.

9. Input-output devices shall be marked similarly to relays for easy reference to wiring diagrams.

10. Diagnostics: A CRT Scope shall be provided in the cabinet for controller diagnostic work. The controller shall also have the capacity to display operational status of all elevators plus statistical and diagnostic information on video monitors and computer printouts for Building Management and maintenance personnel. The system shall also provide diagnostics for analyzing system performance and trouble-shooting including historical data for reviewing performance over time.

11. Provide all necessary filters, traps, etc., to eliminate all noise being transmitted back into the building electrical system. Also, the controller shall be properly protected against and/or protect all outside influences, i.e., radio or T.V. signals.

12. Variable Voltage Variable Frequency Power (AC) Control System

    a. The elevator hoist machine shall have a AC motor. The control of the hoisting motor shall be by means of a solid state drive system. The speed, acceleration and deceleration shall be automatically and continuously controlled by varying the frequency and voltage of the motor. A closed loop system shall be provided.

    b. The drive shall utilize a 3 phase, full wave rectifier and capacitator bank to provide direct current for the solid state inverter. The control principle shall be based on constant flux control utilizing pulse width modulation.

c. A means shall be provided for removing regenerated power from the drive DC power supply. This power shall be dissipated in resistors or returned to the 3 phase AC power line. Failure of the system to remove the regenerated power shall cause the drive output to be removed from the hoist motor.

d. The final stopping shall be performed independent of the machine brake which shall be applied to hold the car at a floor only after the car has stopped.

e. The drive shall not create excessive audible noise in the elevator motor and control system.

f. The drive system shall include but not necessarily be limited to the following features:

1) Maintain a car speed within +/-5% of the contract speed.
2) Protection against excessive motor current in addition to normal overload relays.
3) Maintain operation within 90 to 110% of nominal line voltage.
4) Line fault protection to prevent operation under:
   a) Loss of phase.
   b) Low line voltage.
   c) High line voltage.
5) The transistor protection shall ensure 100% protection of the transistors and prevent fuse blow-out.
6) Continuous supervision of the braking resistors shall be provided.
7) Motor contacts shall disconnect the motor stator winding during each stop. In normal operation, the contactors shall operate only under zero current conditions, but must be capable of interrupting the line current should an emergency stop be required.
8) The drive system shall continuously monitor the hoisting motor operation and motor torque in order to ensure 100% safe elevator operation at all time.
9) Provide each controller with the manufacture's cover/door.

2.8 CAR LEVELING DEVICE, NON-PROPRIETARY

A. Provide each elevator with an accepted car leveling device that shall automatically bring the car to a position level +/- 1/4" with any floor, regardless of the load in the car or its direction of motion. The device shall correct overtravel and undertravel as well as rope stretch due to variations of load. Correction shall be in small steps without surges to eliminate tripping hazard.

B. Leveling to IP 8300 or approved equal.

2.9 RAILS

A. All car guide rails shall be plumbed within 1/8" throughout their entire length. All car rail joints shall be equally strong with the rail section in tension, compression and distortion.

B. Special brackets shall be installed if necessary to suit the structural steel as shown on the steel drawings. When the building is completed, the Contractor shall check the alignment of the rails and shall realign the rails where the alignment has been changed by compression of the building structure.

C. During the process of reworking the guides, the Contractor shall call to the attention of the Owner any rail stack that is noticeably out of alignment or any rail section that has taken a permanent set. The final decision of the proper method of correcting the condition shall be rendered by the Owner.

D. Where floor heights exceed 14'-0" and intermediate supports are not shown on the steel drawings, this Contractor shall provide suitable channel backing on all guide rails.

E. Car and counterweight rails must be thoroughly cleaned and smoothed before cars are put in operation. When cars are tested, they must be free from any noise due to rough or rusty guides and the car guides must be free from any signs of abrasion.

F. Furnish to the General Contractor the required inserts with a drawing detailing the exact location of each insert. The General Contractor will install the inserts at the locations as detailed on the drawing.

2.10 HOIST AND GOVERNOR ROPES

A. Roping for all elevators shall be 1:1.

B. Provide hoist ropes of high grade traction steel, 8 x 19 Seale construction, especially designed for elevator service having a factor of safety at least equal to that specified in the ANSI Code. They shall be securely attached at both ends into the shackles, using the method specified in the ANSI Code.

C. The governor ropes shall be steel construction, 8 x 19 Seale, especially designed for elevator service. The two ends shall be securely fastened together at the car and shall be attached to the safety operating mechanism.

D. All ropes shall be cut and tagged for installation on each elevator.

E. Ropes for each elevator shall be cut in sequence from any run.

2.11 SPEED GOVERNORS

A. Provide speed governors of the centrifugal, self-oiling type. The safety rope grip shall lock in position when the governor throws and shall be held in contact with the rope both by springs and by the sliding action and pull of the rope on the grip. Governor jaws shall be machined and so arranged that if worn, they can be replaced. Speed governors shall be located in machine rooms.

B. The diameter of governor sheave shall be not less than thirty-two (32) times the diameter of the governor rope. The operation of the governor on over speed shall open a switch disconnecting the power from the elevator and shall trip the safety mechanism.

C. The governor shall be accurately adjusted and sealed with the tripping speed specified in the ANSI Code.

2.12 SAFETY

A. Provide a mechanical safety of the self-resetting type mounted under all car platforms securely bolted to the frame. It shall be actuated by a centrifugal governor mounted on structural steel channels in the machine room and connected to the safety tripping mechanism by a continuous governor rope attached to the car frame passing over the governor sheave and a weighted tension sheave in the pit.

B. The safety mechanism, when tripped, shall engage the rails.

2.13 CAR SLING AND PLATFORM

A. The car platforms shall be of sizes as indicated on the drawings. Car sling and safety plank for the elevators shall be constructed of steel plates, steel castings, and structural steel shapes. The car sling shall be provided with rubber roller guides as hereinbefore specified, located top and bottom on each side of sling.

B. The elevator car platform shall consist of a suitably floored frame built of structural steel shapes securely riveted and bolted together. The floor shall consist of not less than two layers, the top layer to be of 3/4" marine plywood laid on a wood sub-flooring or steel frame with wood stringers and a single layer of 3/4" marine plywood laid on the stringers securely screwed down of 12" centers, or shall be constructed entirely of steel suitably reinforced. The platform shall rest on rubber pads which are supported on an auxiliary steel frame fastened to the car frame to form an isolating cushion between the car and steel car frame. The bottom of each car platform shall be covered with #26 gauge sheet iron. The entrance to the car shall be provided with one-piece non-slip extruded aluminum threshold flush with finished floor.

C. Finished floor of shall be in a design as selected by the Architect.

D. Provide each elevator car platform with a sheet steel toe guard, the full width of door opening and extending downward from the car sill a distance of approximately 48", with the lower edge curved inward.

E. Provide each elevator with suitable receptacles fitted with wire lamp guards on top of the car and beneath the car platform. Provide a suitable plug receptacle on top and bottom of the car.

F. Provide on top of each car an inspection station on an extension cord marked "stop", "up", and "down".

2.15 COUNTERWEIGHTS

A. Provide for each elevator a counterweight equal to approximately the weight of the complete car and 40% of specified load.

B. The counterweight shall consist of steel weight sections fitted in a frame. The frame shall be constructed of steel shapes securely bolted, riveted or welded together. The weight sections shall be held within the frames by heavy tie rods which shall pass through holes in each weight section.

C. Each weight should be truly balanced with the weight equally distributed across the width of the frame.

D. Counterweight must be designed to suit the space conditions indicated on drawing. The car platform and clearances shown cannot be reduced.

2.16 ROLLER GUIDES

A. Provide all elevators with 6" roller guides and base on top and bottom of each car frame and 3" roller guides and base on the top and bottom each counterweight frame for each guide rail. Each roller guide shall consist of three (3) rubber tired wheels to run on the three (3) finished rail surfaces. The wheels shall be equipped with ball bearings and shall be held against the rail surfaces by adjustable springs, all contained on a substantial metal base. The roller guides shall run on dry guide rails, not lubricated. All rollers are to be free enough to turn by hand with a minimum of pressure.

B. Car roller guides to be Elsco Model A.

C. Counterweight roller guides to be Elsco Model D.

2.17 TERMINAL STOP DEVICES

A. Provide upper and lower normal terminal stopping devices that shall be arranged to automatically stop the car from speed specified within the top clearance and bottom over-travel independent of the operating device, final terminal stopping device and the buffers.

B. Provide final terminal stopping devices that shall automatically stop the car and counterweight from speed specified within the top clearance and bottom over travel

independent of the operation of the normal terminal stopping device with the buffers operative.

C. Final terminal stopping devices shall be through bolted to the rails.

2.18 CAR AND COUNTERWEIGHT BUFFERS

A. Provide suitable spring buffers under the car and counterweight for each Elevator.

B. Provide all steel required to brace buffers and pipe stands.

C. All buffers shall be mounted on continuous channels, fastened to the guide rails and supported from the floor of the pit.

D. Provide a switch in each pit, arranged to interrupt the power supply and apply the brake independently of the regular operating device to permit safe access to pit for servicing the equipment.

2.19 CAR POSITION INDICATOR, NON PROPRIETARY

A. Provide a car position indicator for each elevator consisting of a readout two inches high, (2") with directional arrows and located over each car door to indicate the car position to the passengers.

B. Readouts in the car station shall be two inch planar, neon gas discharge displays, alphanumeric type, neon orange color with 130 viewing angle or approved equal.

C. Faceplate to be stainless steel, protected by a 1/4' thick lexan cover.

2.20 HALL POSITION INDICATORS, NON PROPRIETARY

A. Provide a car position indicator over each corridor door at both landings consisting of a readout two inches high,(2") with directional arrows. Cover plate to be secured with tamper-proof stainless steel screws.

B. Face plate shall be stainless steel, protected by a 1/4" thick lexan cover.

2.21 CAR SIGNAL AND OPERATING PANEL, NON PROPIETARY

A. Provide in each elevator car, panels stainless steel and surface mounted.

B. The following items shall be included on the panel unless otherwise specified:

1. A complete set of vandal-proof, positive stop pushbuttons corresponding to each floor served, with "call registered lights" in the button in each car station.

2. The open door button.

3. The safety switch. (Emergency stop switch)

4. The car light switch.

5. The fan switch, two speed.

6. Keyed switch to change from "Automatic" operation to "Independent" operation.

7. Emergency light with battery and trickle charger.

8. Emergency light test switch.

9. Grill for the communication speaker.

10. NYC-ID identification number to be engraved in one inch (1") letters.

11. "NO SMOKING" to be engraved in 1-1/2" letters.

12. Capacity to be engraved in 3/4" letters.

13. Roosevelt Island Tram to be engraved in one inch (1") letters.

14. “CERTIFICATE ON FILE IN R.I.O.C. OFFICE IN ½ LETTERS AND LOCATED ON THE KEYED COVER.

15. All switches, except the emergency switch, shall be key-operated and located behind the keyed cover.

C. The car signal panels shall be located as required by Code including the ADA requirements and shall include the markings adjacent to each button, switch, etc. The BRAILLE indications shall be square and engraved in the plate. Applied plates will not be accepted.

D. Plate to be secured by Ace or equal type locks and properly hinged to prevent bowing.

E. Provide a G.F.I. duplex receptacle in each car and locate behind the keyed cover.

2.22 CAR PUSHBUTTONS, NON PROPIETARY

A. Provide car pushbuttons that shall be of vandal-proof (positive stop) type with floor designation engraved in the button "with call registered lights in the buttons". The circuit set up by the pressing of a signal button on the car control panel shall be reset or extinguished when arriving at the designated floor.

B. All pushbuttons shall be a minimum of 1-1/4" diameter convex in design.

2.23 SAFETY SWITCH (Emergency Stop Switch)

A. Provide a safety switch which shall be of a distinct color from the other switches and pushbuttons and shall be so located, etc., as not to become confused with the other switches. The operation of the safety switch shall cut off all power, apply the brake and ring a 6" diameter bell under the car platform.

2.24 DIRECTIONAL LANTERNS, NON PROPIETARY

A. Provide directional lanterns in each car door jamb, (2) per car with double lights. The lantern shall be connected into the control and signal system so that the proper light will be illuminated as a car approaches to stop at a floor in answer to a call.

B. Provide in each lantern a single stroke bell and connect to ring the number of times as required by Code when lights are energized.

2.25 LANDING PUSHBUTTONS, NON PROPIETARY

A. Provide landing pushbutton call station that shall be of the vandal-proof (positive stop) type with arrows engraved in the button with "call registered lights in the button" as hereinbefore described. Button mechanism shall be of substantial construction for expected use. Contacts shall be of the rubbing type of silver or composition metal and shall be arranged so as to equalize pressure and prevent undue compression of the springs. Buttons shall be of the short throw type and be 1-1/4" outer diameter.

B. Locate the pushbuttons at the required ADA height.

2.26 ELEVATOR COMMUNICATION SYSTEM

A. Provide all equipment, accessories and materials complete and in strict accordance with the specifications. All materials and/or equipment necessary for proper operation of the system not specified or described herein shall be deemed part of this specification.

B. Provide facilities for originating calls and establishing two-way communication from each elevator cab to the machine room.

C. Provide facilities for complying with the requirements of the hands-free communication as outlined in the ADA law.

D. Provide a trickle charger and battery as a part of the communication system. In the event of a power failure, the battery shall be able to provide for full communication for a period of two (2) hours.

2.27 CAR AND HATCHWAY DOOR HANGERS AND TRACKS, CENTER OPENING, NON PROPIETARY

A. Provide hangers for car doors and hatchway doors of the heavy duty sheave type, consisting of two ball bearing sheaves not less than 3-1/4" diameter, enclosed in heavy steel housings. The track shall be of high carbon steel not less than 2" x 1/2". Sheave wheels for the car door hangers shall be made of, or tired with, a suitable sound reducing material other than rubber. Sheave wheels for hatchway door hangers shall be made of steel tired suit suitable sound reducing material other than rubber. All sheave wheels shall rotate in a grease packed precision ball bearing. Each hanger shall be equipped with two (2) ball bearing up thrust rollers not less than 1-1/2" diameter with eccentric adjustment.

2.28 HATCHWAY DOOR AND CAR DOOR CONTACTS, NON PROPIETARY

A. Provide each elevator hatchway door and each car door with an electric switch which will prevent the operation of the elevator unless the car door is closed and all hatchway doors are locked in the closed position.

B. These switches shall be positive in operation and must be so located and designed as to be protected from mechanical injury and the possibility of short circuits.

2.29 ELECTRIC DOOR OPERATORS, CENTER OPENING, NON PROPIETARY

A. Provide a MEDIUM speed electric operator, capable of operating a hoistway door and car door simultaneously from the closed position to within three (3) inches of full-open position (or vice versa) at a speed of approximately two and one-half (2-1/2) feet per second. The closing speed shall be slightly slower than the opening speed. The movement of the hatchway and car doors shall be controlled simultaneously by the normal operation of the elevator controls. The doors shall operate smoothly and without slam in both opening and closing directions. Each hatchway and car door shall be cushioned in its final movement in each direction of travel. Electric power shall be used in the opening and electric or spring power may be used in the closing movement.

B. All levers operating the doors shall be constructed of heavy steel members and all their pivot points shall have ball or roller bearing of not less than one (1) inch outside diameter or bronzed bushed bearings of ample size with positive means of lubrication. In case of interruption or failure of the electric power from any cause, the mechanism shall be so designed that it shall permit manual emergency operation of both the hatchway and car doors and the hatchway doors shall continue during emergency operation to be self-locking. The door operators shall operate in conjunction with, or incorporate in their design, or be equipped with all interlocks or safety switches herein specified.

C. Provide 3-D door protection unit on each car door.

D. Provide Z-bar reinforcement on each car door and locate between the nylon guides.

2.30 HATCHWAY ENTRANCES-CENTER OPENING

A. Provide at each door opening for each elevator complete metal entrances, 3'-6" wide consisting of jambs, doors, sight guards, hanger coverplates, headers, dust and toe plates, angle struts, sills and sill supports, facias, hardware, etc. All hatchway entrances shall meet the 1-1/2 hour fire test code requirements.

1. Frame: The frames at all openings for elevators shall be made of not less than 12 gauge furniture steel. They shall be bolted to form one-piece frames and shall have suitable sound-deadening materials. They shall be as designed by the Architect and securely fastened and shall be returned on the hoistway side to present a neat appearance.

2. Sills: shall be extruded aluminum for all elevators as selected by the Architect with approved wearing surfaces and of sufficient length to receive the two supporting struts. They shall be securely fastened to the building beams by means of 3/16" formed steel brackets, or equivalent, suitably spaced for maximum support.

3. Struts: shall be located and fastened at each end of the header and be of a size as recommended by the Contractor, and sufficient to accommodate the operating equipment. They shall be continuous and securely fastened to the sill and building beams above.

4. Headers: 3/16" thick, formed steel, so arranged to receive hangers and they shall be securely bolted to the two supporting struts.

5. Cover plates: #14 USSG steel and shall extend the full travel of the doors. They shall be made in removable sections with the section above the door opening easily removable from within the car for convenient access when servicing the hangers.

6. Fascias: #14 gauge steel reinforced to insure a flat even surface throughout and shall be securely fastened to the header and sill above. They shall be centered on the doorway and shall extend 6" each side of the jamb opening.

7. Toe Guards: #14 gauge steel supplied for the lowest landing and shall have a straight portion which shall extend from the bottom landing to the top buffer plus the compression of the buffer and then be gradually beveled to the wall. They shall be centered on the doorway and shall be 6" wider than the jamb opening on each side.

8. Dust Plates: shall be of not less than #16 gauge steel and shall be supplied above the top landing and gradually beveled back to the wall. They shall be centered on the doorway and shall extend 6" on either side of the jamb opening.

9. Sight Guards: shall be #14 gauge best grade of metal as selected to coincide with the door finish and material. They shall be installed in a manner to reduce to a minimum the clearance between the hoistway doors

and the car doors so as to conceal the hoistway and car beyond the door opening.

10. Doors: shall be #16 gauge furniture steel at all openings for all elevators, double sheet formed vertical sections running the full height of the doors and spaced 9" apart and so designed to secure the front and rear plates. The bottom of the doors shall be furnished with demountable laminated phenolic guides to run in the sill grooves with a minimum clearance to insure quietness of operation. A reinforcement shall be installed at the center of each panel between the two bottom guides. Such reinforcement shall be fabricated of twelve (12) gauge stainless or galvanized steel and shall have a minimum length of eight (8) inches and minimum height of two and one fourth inches (2-1/4") for single panel sliding doors. Multiple panel doors shall be equipped with such reinforcement equal in length to the bottom guides and a minimum height of 2-1/4". The reinforcement shall engage the corresponding member by not less than three eighths (3/8").

11. Transom: #14 gauge bronze flush transoms for the lobby openings for all elevators, double sheet formed vertical sections so designed and reinforced to secure the hanger tracks.

B. Provide Braille jamb plates at every landing.

C. Provide in each hatchway door access holes and ferrules.

2.31 GLASS CAR ENCLOSURE

A. General: Provide a glass Car Enclosure for each elevator, as indicated on the drawings and to comply with the A-17.1 code, section 2.14.

PART 3 – OPERATION

3.1 OPERATION

A. The Elevators shall be arranged for "Duplex Collective", with or without independent operation as follows:

1. The elevators shall operate from a single riser of pushbuttons with "call registered lights" at the landings. "Up" and "Down" pushbuttons shall be provided for the intermediate landings, and a single button at the terminal landings set in a flush mounted case.

2. Provide a key-operated switch for each elevator for selecting "Independent Service".

3. The operation shall be such that the momentary pressing of one or more buttons shall send the car to the designated landings for which the buttons

have been pressed in the order in which the landings are reached by the car, irrespective of the sequence in which buttons have been pressed and shall illuminate the proper car lantern's. During this operation, the cars shall also answer the calls from the landings; but only one car shall respond to any one call, and it shall be the car nearest the call and set for the direction of the landing button pressed.

4. The control shall be arranged so that, normally, one car shall be parked at the first floor and the other a free car to answer the landing calls. Should both cars happen to finish their calls at the first floor, the car which arrived there first shall become the free car to answer subsequent landing calls. An idle free car shall answer landing calls from above or below its position.

5. When the free car is clearing calls, the other car parked at the first floor shall automatically answer landing calls should the following conditions prevail:

   a. Should an up call be registered from a landing below the free car while it is traveling up.

   b. Should any up call or down call be registered from a landing above free car when it is traveling down.

6. Either car shall always respond to its own car button calls regardless of the direction of the landing calls, and all car movements shall be subject to the interlock circuits being established. When either car is taken out of service for any reason, the other car shall automatically answer all calls from the landing and its own car buttons.

7. A key-operated switch shall be provided in each car station and be marked "Independent Service" and shall operate as outlined herein. When this switch is thrown to the "Independent Service" position, it shall cancel all car calls for that car and transfer landing calls to the other cars and permit the car to be taken direct to any floor by pressure of the proper car button. Doors shall not close until a car button is pressed or until the key-operated switch is opened. Opening of the switch shall restore the car to normal operation.

8. Provide a 3-D solid state micro scan unit on each elevator. This system shall contain a minimum of 32 infrared beams strategically placed at intervals along the leading edge of the car doors, creating a detection screen in the elevator entrance. The micro scan unit shall be insensitive to dust, moisture and vibration and to be encased in an aluminum section. It shall close the doors, automatically, momentarily after the last entering or leaving passenger, and shall distinguish between stops made for a car call and stops made for corridor calls. The electronic device shall operate at both terminal and intermediate floors to prevent the car and hatchway doors from starting to close if a person or sizable object is in the doorway.

It shall cause the doors to stop and reopen if, while closing, a person or object enters the doorway.

B. As required, operation of elevators under fire or other emergency conditions shall be provided in accordance with Local Law. Also, this Contractor shall extend the necessary wires to a terminal strip in each machine room that will activate this emergency service when a lobby smoke detector is activated.

3.2 SPEED REGULATION, ETC.

A. Speed regulation shall be such that the maximum velocity attained with any load up to full load in the car on either up or down motion shall not vary more than 5% plus or minus from normal operation velocity and only the manufacturer's latest equipment will be accepted.

3.3 EMERGENCY CONTROLS

A. Provide the following operation on emergency power:

1. When the normal power supply fails, all cars shall shut down. Emergency power of the same characteristics as the normal power supply shall be supplied by others to the elevator feeders approximately 15 seconds after loss of normal power. A manual selection switch shall be provided to select automatic operation or manual car selection operation.

2. When automatic operation is selected, one car shall automatically start and travel to the main floor where it shall stop, open the doors, and then shut down. After the first car shuts down, the other cars shall individually operate as described above. After all cars except the last have moved to the main floor and opened the doors, a preselected car shall operate at rated speed to serve car and hall calls.

3. When manual operation is selected, one selected car shall be started and travel to the lower dispatch terminal at rated speed. Selection shall be by a manual selector switch whereby one car at a time may be selected for operation. Selection of another car shall cause the power to be removed from all other elevators and be transferred to the one selected elevator. When normal power is restored, there shall be a delay of approximately 15 seconds in the transfer from emergency to normal power to the elevator feeders.

B. Others shall provide the emergency power supply with necessary transfer provisions from normal to emergency supply and vice versa on the elevator feeder and two #12 gauge wires from the transfer switch to the elevator controller. These two wires shall be connected to a transfer switch contact which is closed only when the transfer switch is in the normal power position.

3.4 EMERGENCY AND SERVICE KEYS

A. Provision shall be made by this Section for Fire Department emergency keys as required by Local Law and service keys as required by Code.

B. Provide hoistway access switches of the 5-pin tumbler type as required by Rule 2.12.7 of ANSI-A17.1 Code, and located at the top landing and the bottom landing when this opening is the only means of access to the pit and located in the hallway pushbutton station.

3.5 PAINTING

A. All exposed iron work in hatchways, except finished faces of guide rails, shall be given one (1) shop and one (1) field coat of paint, after being finally adjusted.

B. All facia plates and hanger housings shall be thoroughly cleaned of all rust, oil, grease, dirt, etc., with wire brush and shall then receive one (1) coat of metallic paint baked on. At least two (2) additional coats separately baked on shall then be applied, color as selected.

C. All hatchway doors and frames shall be thoroughly cleaned of all rust, oil, grease, dirt, etc., by sandblast, benzine dip or otherwise and shall then receive one (1) coat of metallic paint baked on. At least two (2) additional coats, color as selected, separately baked on shall then be applied.

D. At the completion of the work, the machine room floors shall receive one (1) coat of a quality deck enamel.

E. At the completion of all work, the pit floor shall be cleaned and shall receive one (1) coat quality deck enamel.

F. At the completion of the work, all machine room equipment shall be identified with their own NYC ID number.

G. Provide insulating floor mats, having proper dielectric properties at the front of each controller for the full width of the equipment and 24 inches deep.

3.6 ELECTRIC WIRING

A. Provide all wiring except trail cables in rigid standard weight or thin wall conduit with steel outlet boxes or wiring troughs, except that a small amount of flexible conduit may be used where not subject to moisture or imbedded in concrete.

B. Rigid conduit shall be galvanized and of the proper size to comply with the National Electric Code requirements. All wiring shall be installed in accordance with the National Electric Code and such local regulations that may apply.

C. Provide traveling cables between car and hatchway that shall be flexible and so hung to relieve strains in the copper conductors. Cables shall have the required number of shielded pairs for voice communication and coaxial cables for T.V. cameras. The shielded pairs for voice communication shall be terminated in the

car station in the cab and the coaxial cable for T.V. shall be terminated in a junction box on top of the cab and shall be properly tagged.

D. All wiring material used shall have flame retarding and moisture resisting outer covering and shall contain the label of approval of the Underwriters' Laboratories. Metal boxes, troughs and ducts shall be of a design to comply with the National Electric Code.

E. Interlock wiring shall comply with requirements of Local Law No. 5.

3.7 PERMITS AND CERTIFICATES

A. Give necessary notices, file drawings and specifications with the departments having jurisdiction, obtain permits or licenses necessary to carry out this work and pay all fees therefore.

B. Arrange for inspection and tests, including Controlled Inspections, of any or all parts of the work if so required by authorities or utility companies having jurisdiction and pay all charges for same.

C. Pay all costs for and furnish to the Owner all certificates necessary as evidence that the work installed conforms with all regulations where they apply to this work.

3.8 TESTS

A. Include tests specified and/or required under laws, rules and regulations of all Departments having jurisdiction.

B. All parts of the work and associated equipment shall be tested and adjusted to work properly and be left in perfect operating condition. Correct defects disclosed by these tests without any additional cost to the Owner. Repeat tests on repaired or replaced work if deemed necessary by the Architect.

C. Notify the Architect at least 72 hours in advance of all tests. Furnish all necessary instruments, gauges and other equipment required for tests.

END OF SECTION 014200

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SECTION 220010 – DESCRIPTION OF PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 STORM DRAINAGE SYSTEMS

A. Roof drainage shall be collected from various areas of the roof and directed to leader pipes connected to building storm drains. Roof storm flow will be restricted by means of roof detention and controlled flow roof drains.

B. Yard storm drainage shall be collected from various areas of yards and directed to underground storm drain pipes connected to building drains with connection to combined house sewer.

C. Accidental water accumulated at elevator pit shall be pumped out to storm drainage system by submersible sump pump located in the pit.

END OF SECTION 220010

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SECTION 220100 – GENERAL PROVISIONS FOR PLUMBING WORK

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the Contract Documents, including the General and Supplementary General Conditions and Division 1 - General Requirements apply to the work of this division.

B. In case of conflict between these General Provisions and other existing or to be issued General or Supplementary General Conditions the more restrictive requirements govern as determined by the Architect.

C. Drawings are diagrammatic and are a graphic representation of contract requirements to the best available standards at the scale required.

D. Riser diagrams and schematic diagrams generally indicate equipment connections to be used for various systems. Provide all work shown on diagrams whether or not it is duplicated on the plans.

E. Specifications include incomplete sentences. Words or phrases such as "the contractor shall," "shall be," "furnish," "provide," "a," "an," "the," and "all" have been omitted for brevity.

F. Except where modified by a specific notation to the contrary, the indication and/or description of any item, in the Drawings or Specifications or both, carries with it the instruction to furnish and install the item complete with all appurtenances or accessories necessary to complete any required system, regardless of whether or not this instruction is explicitly stated as part of the indication or description.

G. Specifications and Drawings are complimentary and are to be taken together for a complete interpretation of the work.

H. Drawings of necessity utilize symbols and schematic diagrams to indicate various items of work. Neither of these have any dimensional significance nor do they delineate every item required for the intended installation. Install the work in accordance with the diagrammatic intent expressed on the electrical and mechanical Drawings, and in conformity with the dimensions indicated on final architectural and structural working drawings and on equipment shop drawings.

I. Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field coordination for the indicated work.

J. Derive information as to the general construction from structural and architectural drawings and specifications.

1.2 DEFINITIONS

A. Where used in this document and accompanying drawings, the following words are defined as listed:

1. "Provide" to supply, install and connect up complete and ready for safe and regular operation of particular work referred to.

2. "Install" to erect, mount and connect complete with related accessories.

3. "Furnish" or "Supply" to purchase, procure, acquire and deliver complete with related accessories.

4. "Work" labor, materials, equipment, apparatus, controls, accessories and other items required for proper and complete installation.

5. "Concealed" embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces or in enclosures.

6. "Exposed" not installed underground or "concealed" as defined above.

7. "Indicated" "shown" or "noted" as indicated, shown or noted on drawings or specifications.

8. "Similar" or "equal" of base bid manufacturer, equal in materials, weight, size, design and efficiency of specified product, conforming with "Base Bid Manufacturer's".

9. "Reviewed," "satisfactory," "accepted," or "directed" as reviewed, satisfactory, accepted or directed by or to Architect.

1.3 QUALITY ASSURANCE AND STANDARDS

A. Make the complete installation in accordance with all state and local municipal codes, all applicable codes and authorities having jurisdiction, and the applicable requirements and standards of the following:

AIA	American Insurance Association
AGA	American Gas Association
IEEE	Institute of Electrical and Electronics Engineers
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials

AWS	American Welding Society
AWWA	American Water Works Association
IBR	Institute of Boiler and Radiator Manufacturers
AMCA	Air Moving and Conditioning Association
MSS	Manufacturer's Standardization Society of the Valve and Fitting Industry
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
PDI	Plumbing and Drainage Institute
SBI	Steel Boiler Institute
UL	Underwriters Laboratories
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
NFPA	National Fire Protection Association

Refer to the Architect for decisions on any items or requirements noted in the specifications or drawings which conflict with the standards listed above. Provide all work necessary to comply with these requirements by the Contractor at no extra cost to the Owner.

1.4 ORGANIZATION OF THE WORK

A. Implement the work called for under this contract simultaneously with the work of other Trades in a manner such as not to delay the overall progress of the project. Be prepared to furnish promptly to other Trades involved at the project all information and measurements relating to the work which they may require. Cooperate with them in order to secure the harmony necessary in the interest of the project as a whole.

B. Put work in place as fast as possible to meet all construction schedules.

C. Keep a competent superintendent in charge of the work. Replace such superintendent if unsatisfactory to the Owner.

D. Maintain a complete file of Contract and shop drawings at the Site available for inspection by Owner's Representatives. Upon installation, initial and date shop drawings.

E. Provide every facility to permit inspection or observation of the work by Owner's Representatives during the course of construction.

F. Be responsible for work until its completion and final acceptance; replace any of the same which may be damaged, lost or stolen, without additional cost to the Owner.

1.5 ACCEPTANCE OF THE WORK

A. Make all workmanship, equipment and materials supplied under this contract acceptable to the Owner and his Representatives, who have the power to reject any items which in their judgment are not in full accordance with the Drawings and Specifications.

1.6 PERMITS, CERTIFICATES AND FEES

A. Obtain and deliver a final Certificate of Approval from the applicable inspection authority having jurisdiction. Make delivery to the Architect for transmittal to the Owner upon completion of the work and before final payment. Pay all charges made by the inspection authority and include their cost in the bid.

B. Include the procurement of and payment for all permits, certificates and fees for the performance of the work in compliance with codes, applicable laws and municipal regulations including those from local utilities for services.

1.7 SCOPE OF WORK

A. The Specifications and the accompanying drawings are intended to secure the provisions of all material, labor, equipment, and services necessary to install complete, tested, and ready for operation the Plumbing and Fire Protection Systems in accordance with the Specifications and Drawings. Provide all systems complete with necessary appurtenances and minor auxiliaries, including offsets to clear interferences and supports which are not shown but are needed to make each system complete in every respect. Provide all work described in the Specifications and not shown on the Drawings, or vice versa, in complete working order. If mention has been omitted of any item of work or material, necessary for completion of the system, then such items must be and are hereby included.

1.8 EXAMINATION OF EXISTING CONDITIONS

A. Before submitting a proposal, the Contractor is responsible for visiting the site of the work and becoming thoroughly familiar with all conditions and limitations. The submission of a proposal will be construed as evidence that such an examination has been made, and later claims for labor, equipment or materials required for difficulties encountered which could have been foreseen had such an examination been made will not be recognized.

B. Verify all grades, elevations, dimensions, and clearances at the site.

C. Examine all work prepared by others to receive the work of this Division and report any defects affecting installation to the Construction Manager for correction. Commencement of work will be construed as complete acceptance of preparatory work by others.

D. Existing conditions, equipment, material, and sizes are shown for reference only. Verify existing conditions and bring any discrepancies to Architect's attention in writing prior to submission.

E. Verify proper operation of all existing plumbing related piping system, valves, pumps, etc. Report to engineer of any defective devices and submit cost for repairs. This trade shall certify all systems (new and existing) to be operational after completion of the construction.

1.9 REMOVAL AND RELOCATION OF EXISTING WORK

A. This trade shall visit the premises, including the present building, and compare same with the drawings and specifications and satisfy himself of the conditions existing at the present building before delivery of his proposal. No additional compensation will be made to the Contractor due to his neglect or failure to comply with the specified requirements.

B. Demolition of existing mechanical systems shall be performed and completed under this Division of the work prior to or simultaneously with the commencement of the work covered under this section.

C. This trade shall remove, relocate, replace, adjust or otherwise adapt or modify existing plumbing and fire protection equipment or apparatus as required by the drawings and specifications and also as may be required when such work is uncovered or when found to interfere with the carrying out of the completion of the work of this trade or other Divisions of the work.

D. The work shall also include the furnishing of all materials, cutting, extensions, connections, repairing, adapting, and other work incidental thereto, together with such temporary connections as may be required pending completion of the permanent work.

E. The work shall also include the removal of materials, as directed, which may interfere with the installations. All such disturbed materials shall be replaced and rearranged to suit the new conditions.

F. Work shall be left in good working order and in a condition equal to the adjacent new or existing work. Any work not shown on the drawings or mentioned in the specification but considered necessary for the completion of the work shall be provided by the contractor under this section without additional charge.

G. Openings for entry of equipment into the building will be provided by another Division of the work. This trade shall remove all obstructions that may interfere with the moving into position and the installation of the new equipment and restore the removed equipment to original condition.

H. Existing risers and runouts shall be adjusted as required to suit the new conditions.

I. Where new outlets are to be provided in present mains, approved welding fittings may be welded to the mains or the mains may be cut and threaded and threaded fittings inserted.

J. The new or altered piping or duct work shall be supported on hangers from beam clamps secured to the overhead beam. Remove concrete fireproofing and replace fireproofing after hangers are installed. If this trade proposes an alternate method of supporting piping or ductwork, he shall obtain permission in writing from the Architect.

K. Where the present facilities are to be extended, all additional apparatus or materials furnished shall match that installed in quality, finish, appearance, design and operation.

L. Prior to submit price, coordinate with general contractor for cutting, patching and repairing.

M. Where present work is damaged in the execution of this contract due to the removal of fixtures, pipes, equipment or apparatus, the same shall be repaired to correspond in materials, quality, shape and finish with that of similar and adjoining work, unless otherwise called for.

N. Should any damage due to the execution of this contract occur to the furniture, fixtures, or any other equipment or apparatus, such damages shall be properly repaired and made good without extra charge, with the supply of new articles or otherwise, as may be required, to leave the building and plant in perfect order at completion.

O. All openings through floor slabs for the installation of new piping shall be drilled from above using an electric drill. These holes in no case shall be more than two inches larger in diameter than the finished openings are required to be.

P. Present material or equipment may be reused only when same is specified or shown on the drawings to be reused or relocated. All other materials and equipment shall be new and as specified. Where present radiation is relocated, new branch piping, valves, traps, etc., shall be provided for same, unless otherwise called for.

Q. This work includes disconnection and removal of plumbing fixtures from walls or floors, disconnecting of piping at stacks or risers and capping to avoid dead-ends, reconnecting all systems as required to assure continuity in circulating and supply lines.

R. Where relocation of fixtures and equipment is required, remove, store and reinstall. Provide all necessary hangers, supplies, traps and stop valves, etc. Do not reuse existing piping except where specifically indicated on the contract documents.

S. The work of taking down and removing any part of present equipment, of making alterations or of preparing for and replacing new work therein shall be done only after permission has been obtained from the Architect.

T. Plan installation of new work and connection to existing work to insure minimum interference with regular operation of existing facilities. Work to be done in accordance with the schedule agreed upon mutually between Owner and the Contractor. All shut-downs shall be made at such times as will not interfere with regular operation of existing facilities and only after written approval of the Owner. To insure continuous operation, make necessary temporary connections between new and existing work.

1.10 SHOP DRAWINGS AND OTHER INFORMATION REQUIRED

A. Prior to purchasing equipment or materials, submit a list of proposed manufacturers.

B. Shop drawings which are submitted out of sequence or without supplemental information necessary for proper evaluation of the submission are subject to delays in processing.

C. Shop drawings must bear the Construction Manager's stamp certifying:

1. That he has checked the submitted subcontractor's shop drawings
2. That the submitted shop drawing is fully coordinated with all interfacing trades and with other trades where interference may occur.
3. That the submitted shop drawings are in conformance with the contract documents.

D. Prior to assembling or installing the work, submit the following for review:

1. Catalog information and factory assembly drawings, as required for a complete explanation and description of all items of equipment.
2. Field installation drawings, as required to explain fully all procedures involved in erecting, mounting and connecting all items of equipment.
3. Scale drawings indicating insert and sleeve locations.
4. Scale composite drawings, by the sheet metal subcontractor, showing all duct work, piping, lighting fixtures, main conduit runs, and drainage piping above the hung ceilings and in the mechanical equipment rooms. The drawings will indicate pipe and duct sizes and their elevation above the floor. Provide layout of plumbing and fire protection work for inclusion on the composite drawing. The signature of each contractor on the composite drawing will attest to full coordination of these drawings.

E. Materials installed or work performed without acceptance of materials is done at the risk of the Contractor, and the cost of removal of such material or work which is judged unsatisfactory for any reason is at the expense of the Contractor.

F. Documents will not be accepted for review unless:

1. Number of copies and type of paper complies with the requirements of the general conditions.
2. Complete information pertaining to appurtenances and accessories is included.
3. Submitted as a package where documents pertain to related items.
4. Properly marked with service or function identification as related to the project, where they consist of catalog sheets displaying other items which are not applicable.
5. Properly marked with external connection identification as related to the project where they consist of standard factory assembly or field installation drawings.

G. Shop drawings and other submissions which are submitted for review will be returned with a Shop Drawing stamp indicating actions based on reviews that are made and Contractor's responses that may be necessary. Actions noted regarding "REVIEW" and "RESPONSE" portions of the shop drawing stamp are defined as follows:

1. Review Portion
   a. Incomplete: Item submitted without Contractor's stamp as stated above.
   b. No Exceptions Taken: Contractor may install the items submitted in conformance with the plans and specifications.
   c. Rejected: Item submitted fails to meet criteria in specifications and/or drawings.
   d. Comments Attached: Additional sheet has been attached to the shop drawing submittal and is being returned to the Contractor; additional sheets may include comments which could not be made on the submittal due to limited space or may request additional information.
   e. Note Marking: Notations made directly on the shop drawing submittal.

2. Response Required by Contractor Portion
   a. Confirm: Contractor to confirm that he will comply with comments made under items ld or le above; if the Contractor agrees with the comments, proceed with the fabrication and installation.
   b. Resubmit: Contractor to resubmit shop drawings for review based upon rejection; paragraph 1c and may also be required under paragraphs ld and le.

1.11 RECORD DRAWING

A. Before commencing work, procure complete set of black and white prints of Contract Drawings.

B. Maintain prints in field office and permanently record, in colored pencil, on such prints, at time of occurrence, deviations from Contract Drawings, due to:

1. Field Coordination
2. Addenda
3. Bulletins

C. Dimension underground utilities from permanent identifiable structural points.

D. Submit up-to-date "in progress" prints to Architect when requesting payment for work installed.

E. Upon completion of work, submit signed certified lithotracings as As-Built and referenced Shop Drawings, along with marked up prints of Record Drawings, to Architect for acceptance.

1.12 AS-BUILT DRAWINGS

A. Before commencing work, procure complete set of litho-tracings of Contract Drawings on 4 mil mylar.

B. Neatly revise to conform with Record Drawings.

C. Conspicuously indicate major deviations in Mechanical Equipment Rooms by specific reference to shop drawings of these rooms and provide an accurate and complete record of the work as installed.

D. Condition of Existing Hospital Building: Maintain portions of existing building affected by construction operations in clean and safe hospital condition throughout construction period. Repair damage caused by construction operations.

1.13 COORDINATION OF WORK WITH OTHER TRADES

A. Coordinate the work of this division with the work of all other Contracts and the utility company and so arrange that there will be no delay in the proper installation and completion of any part or parts of each respective work wherein it may be interrelated with that of this Contract so that generally all construction work can proceed without delaying the completion of the project. Forward all communications of a coordinating nature to the Architect via the Construction Manager.

B. Examine contract drawings and specifications for all other trades relating to this project, verify all governing conditions at the site, and become fully informed as to the extent and character of the work required and its relation to other work in the building. No consideration will be granted for any alleged misunderstanding of the materials to be furnished for work to be done.

C. Scaled and figured dimensions with respect to the items are approximate only; sizes of equipment have been taken from typical equipment items of the class indicated. Before proceeding with work, carefully check all dimensions and sizes and assume full responsibility for the fitting-in of equipment and materials to the building and to meet architectural and structural conditions.

D. Coordinate work with other disciplines. Confer with other contractors whose work might affect this installation; and arrange all parts of this work and equipment in proper relation to the work and equipment of others, with the building construction and with architectural finish so that this work will harmonize in service, appearance, and function.

E. Install exposed piping to provide the maximum amount of headroom but in no case less than 7 feet above the finished floor. Install piping concealed in areas where hung ceilings or other furred spaces are indicated.

F. Refer to the Architectural Drawings for ceiling heights, locations and types of hung ceilings and furred spaces.

G. Furnish to the Contractors for General Construction, detailed advance information regarding all requirements related to work under other Divisions and/or Sections. Furnish sizes, accurate data, and locations of any and all pads, pits, chases, sleeves, and slots through floor slabs, walls, foundations, ceilings, roof, and other special openings required for work under this Division.

H. The HVAC Contractor shall provide sepia drawings for trade coordination. The sepia of this "coordination" drawing will be circulated in timely fashion to the other trades for indication of their work to permit coordination. Attend coordination meetings held in location and at frequencies in accordance with the directions of the Construction Manager. When coordination is complete to the satisfaction of the Construction Manager, "sign off" the coordination drawings. See "SHOP DRAWINGS AND OTHER INFORMATION REQUIRED."

1.14 DELIVERY AND RECEIVING

A. Owner-furnished equipment will be delivered, crated or otherwise packaged to the site delivery point selected by the Construction Manager. This Contractor is responsible for accepting delivery of all Owner-furnished items which are under his trade jurisdiction and place them in their final location.

B. Where items cannot be immediately placed in their final position, this Contractor is responsible for storing and protecting all Owner-furnished items until the time of their final installation. This contractor is responsible for the care and protection

of the items until acceptance by the Owner. Coordinate delivery of Utility Company furnished equipment with the delivery policy of that company.

1.15 PROTECTION, MAINTENANCE AND PRODUCT HANDLING OF PLUMBING EQUIPMENT

A. Deliver and store Plumbing and Fire Protection equipment at the site, properly packed and crated until finally installed. Store materials in spaces as designated by the General Contractor. Investigate each space through which equipment must be moved. If necessary, have equipment shipped from manufacturer in crated sections of size suitable for moving through restricted spaces.

B. Adequately protect uninstalled and installed equipment and materials against loss or stealing, damage caused by water, paint, fire, plaster, moisture, acids, fumes, dust or other environmental conditions, or physical damage, during delivery, storage, installation and shutdown conditions. Replace any damaged or stolen material without extra cost to the Owner.

C. Provide effective protection for all material and equipment against damage that may be caused by environmental conditions. Do no work when conditions of temperature in area or moisture on materials or substrates are not in accordance with material manufacturer's recommended conditions for installation.

D. Maintain all equipment and systems installed, until final acceptance by the Architect and the Owner. The operation of the equipment by the Owner does not constitute an acceptance of the work. Work will be accepted only after the Contractor has adjusted his equipment, demonstrated that it fulfills the requirements of the Drawings and Specifications, and has furnished all required certificates.

E. Provide effective protection against damage for all materials and equipment during shipment, and storage at the Project Site. Cover all stored equipment to exclude dust and moisture. Place stored equipment on pallets or racks with appropriate weather cover.

F. After duct work, piping and equipment are installed, cover openings to prevent entrance of water and foreign materials. Close openings with temporary metal or plastic caps.

G. Protect all rough and finished floors and other finished surfaces from damage which may be caused by construction materials and methods. Protect floors with tarpaulins, chip pans and oil-proof floor covering. Protect finished surfaces from welding and cutting splatters with baffles and splatter blankets. Protect finished surfaces from paint droppings, adhesive and other marring agents with drop cloths. Protect other surfaces with appropriate protective measures.

H. Deliver materials to Project Site in manufacturer's original unopened containers with manufacturer's name and product identification clearly marked thereon.

I. After completion of project, clean the exterior surfaces of equipment furnished in this Division including concrete residue.

1.16 EQUIPMENT AND MATERIALS

A. Provide Equipment and Materials required for installation under the Specifications new and without blemish or defect. Provide equipment and materials which will meet with the acceptance of authorities having jurisdiction over the work. Where such acceptance is contingent upon having the products listed or labeled by Underwriters Laboratories Inc., or other test laboratory, provide products so listed or labeled. Where no specific indication as to the type or quality of material or equipment is indicated, furnish a first class standard article.

B. Wherever a manufacturer of a product is specified and the terms "other approved" or "approved equal" or "equal" or "similar to" are used, the substituted item must conform in all respects to the specified item. Consideration will not be given to claims that the substituted item meets the performance requirements with lesser construction. Performance as delineated in schedules and in the Specifications indicate minimum performance. In many cases, equipment is oversized to allow for pick-up loads, derating and future loads which cannot be delineated under the minimum performance.

C. Provide all equipment of one type (such as valves, fans, pumps, coils, etc.) produced by one manufacturer.

D. Substituted equipment where permitted and accepted must conform to space requirements. Replace at Contractor's expense any substituted equipment that cannot meet space requirements, whether accepted or not. Make any modifications of related systems as a result of substitutions at Contractor's expense.

E. Note that shop drawings, or other information submitted in accordance with the requirements hereinbefore specified, do not assure that the Architect, or any other Owner's Representative, attests to the dimensional suitability of the material or equipment involved. Architect's failure to object to shop drawings does not invalidate the Drawings and Specifications if in conflict, unless a letter requesting such change is submitted and accepted on the Architect's letterhead.

F. Substitutions of equipment for that listed on the schedules or designated by model number in the Specifications will not be considered if the item listed or described is not a regular cataloged item shown in the current catalog of the manufacturer and been successfully used for a period of not less than five years.

1.17 SEPARATION OF WORK BETWEEN THE TRADES

A. The specifications describe in detail the work included for each trade. The following summary is an outline of the work to be "Provided," "Furnished" or

"Installed" by each of the trades included in the contract, i.e., General Contractor, Plumbing, Sprinkler, HVAC, [Building Management System] and Electrical.

B. In the absence of more detailed information, consider the list as specific instructions to include such work in the named contract.

C. Abbreviations are as follows:

1. "Oth" - Other than Electrical or Mechanical
2. "Plb" - Plumbing
3. "Spr" - Sprinkler
4. "Htg" - Heating, Ventilating and Air Conditioning
5. "Elec" - Electrical
6. "BMS" - Building Management System
7. "f" - Furnished
8. "i" - Installed
9. "p" - Provided (Furnished and Installed)

ITEM	Oth	Plb	Spr	Htg	Elec	BMS	Remarks
Motors for Mechanical Equipment	_	p	p	p	_	_	
Motor Controls and For Mechanical delineate Equipment	_	f	f	f	i	_	Specifications drawings detailed exceptions.
Wiring for Mechanical Equipment Motors	_	_	_	_	p	_	Specifications and drawings delineate detailed exceptions.
Wiring for Mechanical Equipment Motor Controls to be And Alarms	_	_	_	_	p	p	Specifications and drawings delineate in detail the work performed by each trade

Temporary Light & Power	_	_	_	_	p	_
Temporary Heat	p	_	_	_	_	_
Temporary Water	p	_	_	_	_	_
Temporary Toilet	p	_	_	_	_	_

ITEM	Oth	Plb	Spr	Htg	Elec	BMS	Remarks
Temporary Fire Protection Or Fire Watch	p	_	_	_	_	_	
Hoisting	p	p	p	p	p	p	
Rigging	p	p	p	p	p	p	
Bracing of Building for Safe Rigging	p	_	_	_	_	_	
late improper Cutting, or work is Chasing, & the Patching	p	_	_	_	_	_	Cost where due to installation or coordination the responsibility of delinquent trade.
Framed Slots And Openings In Walls, Decks, And Slabs	p	_	_	_	_	_	Includes drilling of holes when required
Hoisting	_	p	p	p	p	p	

ITEM	Oth	Plb	Spr	Htg	Elec	BMS	Remarks
Waterproof Sealing of Sleeves thru Waterproof Slabs, Decks, And Walls		p	p	p	p	p	
Fireproof Sealing of Excess Openings In Slabs, Decks, And Fire, Rated Walls		p	p	p	p	p	
Excavation And Backfill Inside Buildings		p	p	p	p	p	
Excavation And Backfill Outside Buildings	p						Coordinate with Site Contractor
Keep Site and Excavation Free From Surface Water During Construction	p						
Fastenings	p	p	p	p	p	p	
Supports	p	p	p	p	p	p	

ITEM	Oth	Plb	Spr	Htg	Elec	BMS		Remarks
Concrete Encasement of Conduit					p			
Below Grade Drainage Inside Building		p						

ITEM	Oth	Plb	Spr	Htg	Elec	BMS		Remarks
Base Flashing Of Electric Conduits Thru Roof (Pitch Pockets)	p							Cap Flashing by Trade
Drain and Vent Thru Roof Flashing		p						
exposed Electrical Handholes, And Covers					p			Red painting of fire protection alarm system circuitry included in electrical.
Finish Painting	p							
Finished Walls And Ceiling Access Doors, Panels and doors Supporting Division Frames same.		i	f	f	f	f	f	Supplying list of location of all items requiring access included in the requiring
frame Plaster Rings And Frames	i				f			Plaster rings and Furnished in electric only for fixtures which are so equipped.
another Rubbish Removal	p	p	p	p	p	p		Where one trade Furnished and installs, the installing trade removes the shipping and packing materials which accumulate.
Special Tools								

For Equipment Maintenance	f	f	f	f	f	f	
Electric Heaters with Integral Fans				p			Line & Control Connections and control device mounting fans included in electric.

ITEM	Oth	Plb	Spr	Htg	Elec	BMS		Remarks
Electric unit Water Heating Equipment		p						Line & Control Connections and control device mounting included in Division 16. Piping and mounting by Division 15.
Electric Power Consuming Items And Controls for Other than Mechanical Equipment, e.g. Motorized Doors	p							
Electric power panels, Heating Cables boxes. Branch For Domestic overcurrent Hot Water Heating		p						Division 16 includes feeders, and back circuits and protection by heating cable installer. Furnishing exact

Concrete Foundations, Pads, Pits, Curbs and providing Bases Inside Buildings	p						dimension of anchors, and vibration mounts and template included in each trade the associated equipment.

ITEM	Oth	Plb	Spr	Htg	Elec	BMS	Remarks
Concrete Foundations, Pads, Pits, Curbs and providing Bases Outside Buildings	p						Furnishing exact dimension of anchors, and vibration mounts and template included in each trade the associated equipment.
frames Masonry Pits	p						Furnishing of covers and associated included in each trade.
frames Sump Pits	p						Furnishing of covers and associated included in each trade.
Concrete Lined Trenches Inside Building Foundation	p						
Prime Coat Painting		p	p	p	p	p	
Field Touch-up Painting of Damaged Shop Coats		p	p	p	p	p	

ITEM	Oth	Plb	Spr	Htg	Elec	BMS	Remarks
Rustproofing Field Cut and Assembled Iron Supporting Frames and Racks		p	p	p	p	p	
Grating and Exterior Wall Louvres	p						
Duct Connections to Louvres				p			
Roof Curb Cap Flashing		p		p			
Roof Curb Base Flashing	p						
Roof Vent Pipe Cap Flashing		p		p			
Vermiculite Fireproof Duct Covering	p						
Equipment and Delivered and by Set in Place	p						Except Mechanical Electrical Equipment Divisions 15, 16, 17.

ITEM	Oth	Plb	Spr	Htg	Elec	BMS	Remarks
Vinyl Tape or Painted Color Coding, Banding, Arrows and Similar Identification For Mechanical And Electrical Work		p	p	p	p	p	

Underfloor and included Heater duct					p		Responsibility for coordination is in this Section.
Light Fixtures				p			See Drawings
Elevators, Escalators and Electrical Dumbwaiters	p						Power connection to disconnect switch included in Section.
Convector Enclosures				p			If manufactured standard; otherwise by G.C.
Roughing to Equipment Furnished by Others	p	p	p	p			

ITEM	Oth	Plb	Spr	Htg	Elec	BMS	Remarks
Domestic Make-up Water connection For HVAC		p					Final including in HVAC.
Fire Extinguishers With Cabinets		p					Mounting by G.C.

D. Each Division is required to supply all necessary supervision and coordination information to any other Division supplying work to accommodate that Division.

E. For items which are to be installed but not purchased as part of this Division, the work includes:

1. Coordination of their delivery.
2. Unloading from delivery trucks driven into any point on the property line at grade level.

3. Safe handling and field storage up to the time of permanent placement in the project.
4. Correction of any damage, defacement or corrosion to which they may have been subjected.
5. Field make-up and internal wiring as indicated for their proper operation.
6. Mounting in place.
7. Connection to building systems, including the purchase and installation of all terminating fittings necessary to adapt and connect them to the building system.

1.18 OPERATING AND MAINTENANCE INSTRUCTIONS

A. After completion of all required equipment and system tests and unless specifically noted elsewhere in these specifications, provide at owner's/operator's convenience, knowledgeable personnel and necessary equipment to reasonably instruct and demonstrate the operation and maintenance of said equipment and system. Arrange for the related manufacturer or authorized representative to assist with this orientation.

B. Before requesting acceptance of work, furnish 5 copies in bound form of a complete instruction manual, typewritten or printed.

C. Include the following in the instruction manuals:

1. Table of Contents
2. Introduction - Explanation of manual and its use
3. Description of system or equipment
   a. Complete schematic drawings of all systems.
   b. Functional and sequential description of all systems.
4. Systems operation
   a. Operation procedures
   b. All posted instruction charts
5. Maintenance
   a. Systems trouble-shooting charts
   b. Procedures for checking out functions
   c. Recommended list of spare parts
6. Listing of manufacturers
7. Manufacturer's data: Where multiple model, type and size listings are included, clearly and conspicuously indicate those that are pertinent to this installation.
   a. Description - literature, drawings, illustrations, certified performance charts, technical data, etc.

b. Operation
c. Maintenance - including complete trouble-shooting charts
d. Parts list
e. Names, addresses and telephone numbers of recommended repair and service companies
f. Guarantee data

1.19 GUARANTEES AND CERTIFICATIONS

A. Guarantee all work to be free from leaks or defects. Replace or repair, as directed by Architect, defective materials or workmanship, as well as damage to the work of the Trades resulting from same for the duration of stipulated guarantee periods.

B. The duration of guarantee periods following the date of acceptance of the entire work, unless otherwise specified, is one year.

C. Submit certification attesting to the fact that specified performance and other criteria are met by all items of equipment.

1.20 SITE VISITS FOR OBSERVATION

A. As the project progresses, the Engineer and Architect, at their discretion, will perform site visits to observe the mechanical and electrical installations. At the conclusion of these site visits, punch lists will be issued to the appropriate Contractor for the deficiencies in the work of his trade. Complete all work and perform all corrective measures as required by the punch lists. After this corrective and completion work has been accomplished advise the Architect and the Engineer in writing that every item on the punch lists has been completed.

1.21 IDENTIFICATION

A. Valves

1. Valve identification to comply with MSSSP-25.

2. Attach a 2" round brass tag stamped with designating numbers 1" high filled in with black enamel to each valve, except those on fixtures.

3. Securely fasten valve tag to valve spindle or handle with a brass chain.

4. Appropriate ceiling tile markers, in areas where removable ceilings occur to indicate location of valves or other devices, to be provided under the general construction division of these specifications.

B. Motor Control Identification

1. Mount black lamacoid nameplates on each motor controller identifying primary control function and individual position indication such as Pump

No. 1, etc. Nameplates to be cut through to white background and have beveled edges. Mounted with chromium plated acorn head screws.

C. Schedule and Charts

1. Furnish to Owner's Representative three (3) complete framed plastic laminated valve tag schedules. Schedule to indicate tag number, valve location by floor and nearest column number, valve size and service controlled.

D. Piping Identification and Coding

1. Apply color coded Polyvinyl Chloride pipe bands identifying pipe contents and direction of flow.
2. On exposed piping, apply bands on 30 foot centers of straight runs, at valve locations, at point where piping enters and leaves a partition, wall, floor or ceiling.
3. On concealed piping installed above removable ceiling construction, apply bands in manner described for exposed piping.
4. On concealed piping installed above non-removable ceiling construction, or in pipe shafts, apply bands at valve or other devices that are made accessible by means of access doors or panels.
5. Apply bands at exit and entrance points to each vessel, tank or piece of equipment.
6. Band widths to be 8 inch for pipes up to 10 inch diameter and 16 inch wide for larger diameter piping. Letter heights stating service to be preprinted on band, 3/4 inch high for 8 inch bands and 1-1/4 inch high for 16 inch bands.
7. For insulated pipes, apply bands after insulation and painting work has been completed.
8. Colors to conform to ASA Standard A13.1. Provide 24 additional bands of each type for future use by owner's personnel.
9. Follow manufacturer's instructions for application procedures using non-combustible materials and contact adhesives.

1.22 PAINTING

A. Deliver all equipment with standard factory finish or as specified. Clean all equipment before acceptance by the Owner.

Except as otherwise specified, finish painting will be done under other Sections of the work.

1.23 DRIP PAN

A. Examine the drawings, and in cooperation with the Electrical Trade confirm the final location of all electrical equipment to be installed in the vicinity of piping. Plan and arrange all overhead piping no closer than 2'-0" from a vertical line to electric motors and controllers, switchboards, panelboards, or similar equipment.

B. Where the installation of piping does not comply with the requirements of foregoing paragraph, where feasible, the piping shall be reloc.

C. Furnish galvanized steel gutters (minimum of 4" high) as follows:

1. Provide and erect a gutter of 20 gauge galvanized steel under every pipe which is within 2'-0" (600 mm) of being vertically over any motor, electrical controllers, switchboards, panelboards, or the like.

2. Each gutter shall be sealed and made watertight, properly suspended and carefully pitched to a convenient point for draining. Provide a 3/4" drain, with valve as directed, to nearest floor drain or slop sink, as approved.

3. In lieu of such separate gutters, a continuous protecting sheet in similar construction, adequately supported and braced, properly rimmed, pitched and drained, may be provided over any such motor, and extending 2'-0" in all directions beyond the motor, over which such piping has to run.

1.24 COORDINATION

A. All equipment, piping and other devices exposed to finished spaces shall meet architects approval. Any installation without prior written approval shall be relocated without cost.

END OF SECTION 220100

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SECTION 220500 – BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. General Provisions for Plumbing Work, Section 15010, applies to work of this Section.

C. The requirements of this section apply to equipment specified elsewhere in the specification.

1.2 DESCRIPTION OF WORK

A. Work includes providing all labor, supervision, materials, equipment, accessories, services and tests necessary to complete and make ready for operation by the Owner, all basic materials and methods for plumbing systems in accordance with Drawings and Specifications.

1.3 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of products of types and capacities required, whose products have been in satisfactory use in similar service for not less than 3 years. Provide products produced by a manufacturer listed as an Acceptable Manufacturer in this section.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's data including printed technical literature, installation, instructions, and catalog cuts for materials, parts, devices, finish, and performance data.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Sleeves:

1. F & S Manufacturing Corp.
2. James B. Clow and Sons

B. Escutcheons:

1. J. R. Smith Manufacturing Company
2. Josam Manufacturing Company
3. Zurn Industries

2.2 SLEEVES

A. Sleeve Product Schedule:

Type Designation	Sleeve Materials
1	#18 gauge, galvanized steel
2	Standard weight galvanized steel pipe
3	Standard weight galvanized steel pipe with a continuously welded water stop of 1/4" steel plate extending from outside of sleeve a minimum of 2" all around; similar to F & S Manufacturing Corp. Fig. 204.
4	Cast iron pipe sleeve with center flange; similar to James B. Clow and Sons No. F-1430 and F-1435.
5	Standard weight galvanized steel pipe with flashing clamp device welded to pipe sleeve or watertight sleeves.

B. Sleeve Caulking and packing product schedule:

Type Designation	Caulking & Packing Requirements
1	Oakum, hemp or lead
2	Incombustible, permanently plastic, waterproof, non-staining caulking compound or pack with mineral wool to within ½" of both construction surfaces and finish with caulking compound as per above. For floor and roof slabs, finish is required on top side of slab only.
3	Packed mineral wool sealed with Johns-Manville "Duxseal" or approved equal; install set screw escutcheons on both sides of wall.

2.3 ESCUTCHEONS

A. Material: anodized aluminum, chrome plated brass for finished spaces; plain brass, cast iron or aluminum for unfinished spaces. Set-screw or spring tension design.

2.4 CONNECTIONS FOR EQUIPMENT SUPPLIED BY OTHERS AND FUTURE EQUIPMENT

A. Capped Outlets: Provide soldered, flanged or threaded pipe ends for extension and connection to equipment by supplying trade.

PART 3 - EXECUTION

3.1 GENERAL EXECUTION

A. Inspection

1. Examine conditions under which equipment is to be installed. Notify Architect in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Installation

1. Install as indicated, in accordance with manufacturer's written instructions, applicable codes and regulations and in accordance with recognized industry practices to ensure that installation complies with requirements and serves intended function.

2. Coordinate as necessary to interface installation with other work.

3.2 SLEEVES

A. Provide sleeves for each pipe passing through walls, partitions, floors and roofs except multiple pipe penetrations may be accommodated in a common boxed opening. Provide code complying packing, caulking or cement fill between pipes and edges of boxed openings.

B. Pack and/or caulk space between pipe or pipe insulation and sleeve as indicated in sleeve application schedule below. Finish with smooth appearance even with sleeve surface.

C. Sleeve and Sleeve Caulking Application Schedule:

Sleeve	Sleeve Caulking

Type		Location and Packing Type
5	Membrane waterproof Floor, roof and wall construction	B Note: Membrane by another trade
2	Non-membrane water-Proof wall construction Where flashing is required	A or B
1 or 2	Interior walls, partitions And floors	B
3 or 4	Exterior Walls	A
2	Interior Fire Rated Shaft Walls	C

D. Sleeve Sizes:

1. For Uninsulated Piping: two pipe sizes larger than pipe passing through sleeve or a minimum of ½" clearance between inside of sleeve and outside of pipe.
2. For Insulated Piping: adequate size to accommodate the full thickness of pipe covering with clearance for packing and caulking.

E. Sleeve Length Schedule:

Location	Sleeve Length
Floor Slabs	Equal to depth of floor construction including finish; in waterproof floor construction, sleeves to extend minimum of 2" above finished floor level.
Roof Slabs	Equal to depth of roof construction including insulation plus 4". Provide threaded or caulked counter flashing to extend down over roofing membrane on pipe.
Walls and Partitions	Equal to depth of construction and terminated flush with finished surfaces.

3.3 ESCUTCHEONS

A. Provide escutcheons on all exposed piping through walls, partitions, floors and ceilings. Escutcheon inside diameter to closely fit pipe outside diameter or insulation outside diameter where pipe is insulated. Cover penetration hole in construction.

B. Escutcheon Application Schedule:

Location	Type
Finished Spaces	Anodized aluminum, chrome plated brass
Unfinished Spaces Excluding Mechanical Equipment Room	Plain brass, cast iron or aluminum

3.4 CONNECTIONS TO EQUIPMENT SUPPLIED BY OTHERS & FUTURE EQUIPMENT

A. Capped Outlets: Provide capped or plugged outlets for all future fixtures to be supplied from wet stacks and for all HVAC or similar equipment. Capped or plugged outlet to be provided within fifteen feet of equipment connections or as indicated, whichever is closer. Coordinate elevation, size and pressure requirements. Provide pressure reducing valves or gas pressure boosters when required.

B. Provide flanged or union valved connections at equipment requiring periodical maintenance. Make connections to equipment so that equipment may be removed, replaced or repaired with a minimum piping change.

C. Contamination Protection: Provide minimum protection for lines connected to all HVAC equipment and other submerged inlets. Where required by Code or elsewhere herein, provide approved type reduced pressure back flow preventer or double check backflow preventer. (See "Domestic Water Systems.").

3.5 EXCAVATION AND BACKFILL

A. All excavation and backfill will be done by the General Contractor. This Contractor is responsible for coordination of trench routing, slope and elevations. Confirm that all of the following methods are complied with.

B. Provide all excavation and backfill in accordance with the following procedures.

1. Excavation, to be in accordance with OSHA standards, in such manner that buried items can be laid to the alignment and depth indicated; excavate only so far in advance of pipe laying as approved.

2. Width of trenches

a. Hold to a minimum consistent with the type of material encountered and the size of the pipe being laid.

b. Width at the top of the trench: not more than 24 inches plus outside diameter of pipe.

c. Regardless of which contractor provides the basic excavation, the Plumbing Contractor is responsible for fine grading of trench

bottom for pipe pitch and for fine excavation to accommodate bells of pipe and fittings.

3. Before fill or backfilling commences, remove trash, debris, and other foreign material from trenches. Fill material to be free from timber, rocks 3" inches or larger, organic material and other unsuitable material as determined by Construction Manager.

4. In filling around pipe, deposit backfill material in successive horizontal layers as not to exceed 6" inches in thickness before completion. Compact each layer thoroughly by means of approved mechanical tapers. Take special care to obtain compaction under pipe haunches. Deposit backfill adjacent to pipes on both sides to approximately same elevation at the same time. Continue this method of filling and compacting until backfill is at least 18" inches above top of pipe.

5. Backfilling for the remainder of pipe trenches to subgrades of paved or landscaped areas: perform by mechanical taping and rolling equipment, except that use of such equipment is prohibited when use may result in damage to pipe lines or structures.

6. Moisten backfill as necessary for proper compaction. Water settling of fill will not be permitted.

7. Complete backfilling of pipe trenches as soon as possible after the pipe is laid and tested.

8. Restore to original condition existing pavement, roadways, walkways, curbs and landscaped areas disturbed during the progress of the excavation and backfill work.

9. Compaction: minimum of 90% of modified AASHO maximum density as defined by ASTM D-1557.

10. Fill not compacted to the required density: re-compact until the specified density is achieved, or remove at the layer and replace with new material.

11. Foundation drainage backfill filter materials to extend a minimum of 6" inches in all direction from the exterior of the pipe. No less than 85 percent to pass through a 3/8" inch sieve and 100 percent to be retained on a number 35 sieve. This material to be known as 3/8" inch gravel or stone, with alternate materials to be a mixture of 70 percent concrete sand and 30 percent medium gravel. Every precaution to be taken to prevent material from entering the pipe. No tools, clothing, debris or other material to be placed in the pipe during installation. All excavations to be backfilled by hand from the bottom of the trench to the center line of the pipe with acceptable filter material in layers of 3 inches and compacted by tamping. From the center line of the pipe to a distance of 1 foot above the top of the pipe, the trench to be backfilled by hand with acceptable material in layers of 6 inches and compacted by tamping. Backfill material will be deposited in the excavation for its full width on each side of the pipe simultaneously. The Contractor to use special care in placing

the backfill so as to avoid injuring or moving the pipe. From 1 foot above the pipe to the finished grade the trench to be backfilled by acceptable mechanical methods.

END OF SECTION 220500

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SECTION 220520 – COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Equipment installation requirements common to equipment sections.
9. Painting and finishing.
10. Concrete bases.
11. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall

comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

PART 2- PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
3.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 15 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings

2.3 JOINING MATERIALS

A. Refer to individual Division 15 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

   a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
   b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Dresser Industries, Inc.; DMD Div.
c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
d. JCM Industries.
e. Smith-Blair, Inc.
f. Viking Johnson.

2. Underground Piping NPS 1-1/2 (DN 40) and Smaller: Manufactured fitting or coupling.
3. Underground Piping NPS 2 (DN 50) and Larger: AWWA C219, metal sleeve-type coupling.
4. Aboveground Pressure Piping: Pipe fitting.

B. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Fernco, Inc.
c. Mission Rubber Company.
d. Plastic Oddities, Inc.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

1. Manufacturers:

a. Capitol Manufacturing Co.

b. Central Plastics Company.
c. Eclipse, Inc.
d. Epco Sales, Inc.
e. Hart Industries, International, Inc.
f. Watts Industries, Inc.; Water Products Div.
g. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Epco Sales, Inc.
d. Watts Industries, Inc.; Water Products Div.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

1. Manufacturers:

a. Calpico, Inc.
b. Lochinvar Corp.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

1. Manufacturers:

   a. Perfection Corp.
   b. Precision Plumbing Products, Inc.
   c. Sioux Chief Manufacturing Co., Inc.
   d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:
   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Metraflex Co.
   d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

2.8 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated and rough brass.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated and rough brass.

E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome- plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic- cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3- EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep- pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type with spring clips.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-

plated finish.

e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.

f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.

g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.

h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.

i. Bare Piping in Equipment Rooms: One-piece, cast-brass type.

j. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.

k. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum- board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. PVC Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).

b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.

c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.

- Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space

R. between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

S. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

T. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration

Firestop Systems" for materials.

U. Verify final equipment locations for roughing-in.

V. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded

3.3 pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

B. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

C. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned.

Use suitable lubricants on bolt threads.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.6

3.7 PAINTING

A. Painting of plumbing systems, equipment, and components is specified in Division 9 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.8 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to

equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.9 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.10 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.11 GROUTING

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 220520

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SECTION 220610 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following hangers and supports for plumbing system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Pipe positioning systems.
8. Equipment supports.

B. Related Sections include the following:

1. Division 5 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 13 Section "Fire-Suppression Piping" for pipe hangers for fire-suppression piping.
3. Division 15 Section "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
4. Division 15 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.

2. Thermal-hanger shield inserts.

3. Powder-actuated fastener systems.

4. Pipe positioning systems.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.

2. Metal framing systems. Include Product Data for components.

3. Pipe stands. Include Product Data for components.

4. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel." And AWS D1.4, "Structural Welding Code--Reinforcing Steel."

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."

2. AWS D1.2, "Structural Welding Code--Aluminum."

3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."

4. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:

1. AAA Technology & Specialties Co., Inc.

2. Bergen-Power Pipe Supports.

3. B-Line Systems, Inc.; a division of Cooper Industries.

4. Carpenter & Paterson, Inc.

5. Empire Industries, Inc.

6. ERICO/Michigan Hanger Co.

7. Globe Pipe Hanger Products, Inc.

8. Grinnell Corp.

9. GS Metals Corp.

10. National Pipe Hanger Corporation.

11. PHD Manufacturing, Inc.

12. PHS Industries, Inc.

13. Piping Technology & Products, Inc.

14. Tolco Inc.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.

2. ERICO/Michigan Hanger Co.; ERISTRUT Div.

3. GS Metals Corp.

4. Power-Strut Div.; Tyco International, Ltd.

5. Thomas & Betts Corporation.

6. Tolco Inc.

7. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- (690-kPa-) minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:

1. Carpenter & Paterson, Inc.

2. ERICO/Michigan Hanger Co.

3. PHS Industries, Inc.

4. Pipe Shields, Inc.

5. Rilco Manufacturing Company, Inc.

6. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland

cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

   a. Hilti, Inc.
   b. ITW Ramset/Red Head.
   c. Masterset Fastening Systems, Inc.
   d. MKT Fastening, LLC.
   e. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated or stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

   a. B-Line Systems, Inc.; a division of Cooper Industries.
   b. Empire Industries, Inc.
   c. Hilti, Inc.
   d. ITW Ramset/Red Head.
   e. MKT Fastening, LLC.
   f. Powers Fasteners.

2.7 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

1. Manufacturers:

   a. ERICO/Michigan Hanger Co.
   b. MIRO Industries.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

1. Manufacturers:

   a. MIRO Industries.

D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

1. Available Manufacturers:

   a. ERICO/Michigan Hanger Co.
   b. MIRO Industries.
   c. Portable Pipe Hangers.

2. Base: Stainless steel.

3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.

4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

1. Manufacturers:

   a. Portable Pipe Hangers.

2. Bases: One or more plastic.

3. Vertical Members: Two or more protective-coated-steel channels.

4. Horizontal Member: Protective-coated-steel channel.

5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.8 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.

B. Manufacturers:

1. C & S Mfg. Corp.

2. HOLDRITE Corp.; Hubbard Enterprises.

3. Samco Stamping, Inc.

2.9 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.10 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).

2. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.

3. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8 (DN 10 to DN 200).

4. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

5. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36 (DN 65 to DN 900), if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.

6. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN 50 to DN 750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. C-Clamps (MSS Type 23): For structural shapes.

6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.

7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

8. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

9. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

10. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).
    c. Heavy (MSS Type 33): 3000 lb (1360 kg).

11. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

12. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

13. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

L. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

M. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

N. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install

hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 7 Section "Roof Accessories" for curbs.

G. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 15 Section "Plumbing Fixtures" for plumbing fixtures.

H. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

M. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

O. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.

2. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
   b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
   c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
   d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
   e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

3. Pipes NPS 8 (DN 200) and Larger: Include wood inserts.

4. Insert Material: Length at least as long as protective shield.

5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 painting Sections. Section "High-Performance Coatings."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 220610

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SECTION 220760 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

4. Fasteners: Stainless-steel rivets rivets or self-tapping screws self-tapping screws.

5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches (38 mm) high.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.

1. Tag Material: Brass, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.5 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches (100 by 178 mm).

2. Fasteners: Brass grommet and wire.

3. Nomenclature:Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."

4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 9 Section "Interior Painting."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.

1. Identification Paint: Use for contrasting background.

2. Stencil Paint: Use for pipe marking.

C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.

4. At access doors, manholes, and similar access points that permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.

7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Pipe Label Color Schedule:

1. Sanitary Waste and Storm Drainage Piping:

a. Background Color: Blue.
b. Letter Color: White

3.4 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220760

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SECTION 221600 - STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All conditions of the Contract apply to this Section.

1.2 SUMMARY

A. This Section includes the following storm drainage piping inside the building:

1. Pipe, tube, and fittings.
2. Special pipe fittings.

B. Related Sections include the following:

1. Division 2 "Combined Sanitary and Storm Sewerage".

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. LLDPE: Linear, low-density polyethylene plastic.

C. PE: Polyethylene plastic.

D. PVC: Polyvinyl chloride plastic.

E. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working-pressure, unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water (30 kPa).

B. Seismic Performance: Storm Drainage piping and support and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Shop Drawings:

1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.

C. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service Weight and Extra-Heavy classes.

B. Gaskets: ASTM C 564, rubber.

C. Mechanical Joints: ASTM B 29, approved performed molded ring secured by pulling the pipe together in such a way as to compress the molded ring or shall be made with a corrosion resistant joint and clamp assembly surrounding a

sealing sleeve of an approved elastomeric material so that the sealing sleeve is firmly compressed by the tightening device in the clamp assembly to provide a gas and water tight joint.

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.

a. Manufacturers:

1) ANACO.
2) Fernco, Inc.
3) Ideal Div.; Stant Corp.
4) Mission Rubber Co.
5) Tyler Pipe; Soil Pipe Div.

b. Number of bands on coupling:

1) Four (4) stainless steel bands for 1 ½” – 4” sizes.
2) Six (6) stainless steel bands for 5” – 15” sizes.

2. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.

a. Manufacturers:

1) ANACO.
2) Clamp-All Corp.
3) Ideal Div.; Stant Corp.
4) Mission Rubber Co.
5) Tyler Pipe; Soil Pipe Div.

b. Number of bands on coupling:

1) Four (4) stainless steel bands for 1 ½” – 4” sizes.
2) Six (6) stainless steel bands for 5” -15” sizes.

3. Heavy-Duty, Shielded, Cast-Iron Couplings: ASTM A 48/A 48M, two- piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve.

a. Manufacturers:

1) MG Piping Products Co.

C. Rigid, Unshielded Couplings: ASTM C 1461, sleeve-type, reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:

a. ANACO.

2.5 STEEL PIPE AND FITTINGS

A. Stainless Steel Pipe: ASME A112.3.1, Type 304 or 316L, Standard Weight or Schedule 40. Include ends matching joining method.

B. Drainage Fittings: ASME A112.3.1**,** stainless steel, Type 304 or 316L.

C. Pressure Fittings:

1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.

2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.

3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized**,** standard pattern.

4. Cast-Iron Flanges: ASME B16.1, Class 125.

5. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125**,** galvanized.

2.6 SPECIAL PIPE FITTINGS

A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:

a. Dallas Specialty & Mfg. Co.
b. Fernco, Inc.
c. Logan Clay Products Company (The).
d. Mission Rubber Co.

e. NDS, Inc.
f. Plastic Oddities, Inc.

2. Sleeve Materials:

a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
b. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

B. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Mission Rubber Co.

C. Rigid, Unshielded, Nonpressure Pipe Couplings: ASTM C 1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:

a. ANACO.

D. Pressure Pipe Couplings: AWWA C219 metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Dresser, Inc.; DMD Div.
c. EBAA Iron Sales, Inc.
d. Ford Meter Box Company, Inc. (The); Pipe Products Div.
e. JCM Industries, Inc.
f. Romac Industries, Inc.
g. Smith-Blair, Inc.
h. Viking Johnson.

2. Center-Sleeve Material: Malleable iron.

3. Gasket Material: Natural or synthetic rubber.

4. Metal Component Finish: Corrosion-resistant coating or material.

E. Expansion Joints: Two or three-piece, ductile-iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-

iron glands, rubber gaskets, and steel bolts.

1. Manufacturers:

   a. EBAA Iron Sales, Inc.
   b. Romac Industries, Inc.
   c. Star Pipe Products; Star Fittings Div.

F. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

1. Manufacturers:

   a. SIGMA Corp.

2.7 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Description: ASTM A 674 or AWWA C105, high-density, crosslaminated PE film of 0.004-inch (0.10-mm) minimum thickness.

B. Form: tube.

C. Color: natural.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground storm drainage piping NPS 2 to NPS 6 (DN 50 to DN 150) and smaller shall be as follows:

1. Stainless Steel Pipe: ASME A112.3.1, Type 304 or 316L, Standard Weight or Schedule 40. Include ends matching joining method.

C. Aboveground, storm drainage piping NPS 8 (DN 200) and larger shall be as follows:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and coupled joints.

D. Underground storm drainage piping NPS 3 (DN 80) and smaller as follows:

1. Extra-heavy class, hub and spigot cast-iron soil pipe and fittings; gaskets; and gasketed joints.

E. Underground, storm drainage piping NPS 4 (DN 100) and larger shall be as follows:

1. Extra-Heavy class, hub and spigot cast-iron soil piping; gaskets; and gasketed joints.

3.2 PIPING INSTALLATION

A. Storm sewer and drainage piping outside the building are specified in Division 2 Section "Storm Drainage."

B. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

C. Install seismic restraints on piping. Seismic-restraint devices are specified in Division 15 Section "Mechanical Vibration and Seismic Controls."

D. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Division 15 Section "Plumbing Specialties."

E. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 15 Section "Basic Mechanical Materials and Methods."

F. Install wall-penetration fitting system at each service pipe penetration through foundation wall. Make installation watertight.

G. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

H. Make changes in direction for storm piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

I. Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's

written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

J. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:

1. Building Storm Drain: 1 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.

2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.

K. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

C. Hub-and-Spigot, Cast-Iron Soil Piping Calked Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.

D. Hubless Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

E. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.4 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in Division 15 Section "Mechanical Vibration Controls and Seismic Restraints."

B. Pipe hangers and supports are specified in Division 15 Section "Hangers and Supports." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.

2. Individual, Straight, Horizontal Piping Runs: According to the following:

a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.

b. Longer than 100 Feet (30 m): MSS Type 43, adjustable roller

hangers.

c. Longer than 100 Feet (30 m), if indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Division 15 Section "Hangers and Supports."

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.

2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.

3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.

4. NPS 6 (DN 150): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.

5. NPS 8 to NPS 12 (DN 200 to DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm) rod.

6. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).

G. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.

2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.

3. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.

4. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.

5. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.

6. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.

I. Install supports for vertical copper tubing every 10 feet (3 m).

J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

3.6 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.

2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. Test Procedure: Test storm drainage piping on completion of roughing-in.

Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

5. Prepare reports for tests and required corrective action.

3.7 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when works stops.

END OF SECTION 221600

***

SECTION 221650 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following storm drainage piping specialties:

1. Cleanouts.
2. Through-penetration firestop assemblies.
3. Roof drains.
4. Miscellaneous storm drainage piping specialties.
5. Flashing materials.
6. Sand Interceptors.
7. Trench drains.

B. Related Sections include the following:

1. Division 15 Section "Sanitary Waste Piping Specialties" for floor drains, connected to sanitary sewer, air admittance valves and grease interceptors.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FOG: Fats, oils, and greases.

C. FRP: Fiberglass-reinforced plastic.

D. HDPE: High-density polyethylene plastic.

E. PE: Polyethylene plastic.

F. PP: Polypropylene plastic.

G. PUR: Polyurethane plastic.

H. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

1.6 COORDINATION

A. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Metal Cleanouts

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

3. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

4. Standard: ASME A112.36.2M for cast iron for cleanout test tee.

5. Size: Same as connected drainage piping

6. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch Hubless, cast-iron soil pipe test tee as required to match connected piping.

7. Closure: Countersunk or raised-head, cast-iron plug.

8. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

9. Closure: Stainless-steel plug with seal.

B. Metal Floor Cleanouts

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

3. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

   a. Josam Company; Josam Div.
   b. Oatey.
   c. Sioux Chief Manufacturing Company, Inc.
   d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   e. Tyler Pipe; Wade Div.
   f. Watts Drainage Products Inc.
   g. Zurn Plumbing Products Group; Light Commercial Operation.
   h. Zurn Plumbing Products Group; Specification Drainage Operation.
   i. Josam Company; Josam Div.

4. Standard: ASME A112.36.2M for cast-iron soil pipe with cast-iron ferrule cleanout.

5. Size: Same as connected branch.

6. Type: Cast-iron soil pipe with cast-iron ferrule.

7. Body or Ferrule: Cast iron.

8. Clamping Device: Required.

9. Outlet Connection: Inside calk Spigot.

10. Closure: Cast-iron plug.

11. Adjustable Housing Material: Cast iron with set-screws or other device.

12. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.

13. Frame and Cover Shape: Round.

14. Top Loading Classification: Medium Duty.

15. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

16. Standard: ASME A112.3.1.

17. Size: Same as connected branch.

18. Housing: Stainless steel.

19. Closure: Stainless steel with seal.

20. Riser: Stainless-steel drainage pipe fitting to cleanout.

C. Cast-Iron Wall Cleanouts

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

3. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

4. Standard: ASME A112.36.2M. Include wall access.

5. Size: Same as connected drainage piping.

6. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.

7. Closure: Countersunk or raised-head plug.

8. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

9. Wall Access: Round cover plate with screw.

10. Wall Access: Round wall-installation frame and cover.

2.2 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ProSet Systems Inc.

3. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.

4. Size: Same as connected pipe.

5. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.

6. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.

7. Special Coating: Corrosion resistant on interior of fittings.

2.3 METAL ROOF DRAINS

A. Stainless Steel Scupper Drain with Angle Grate

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products similar to J. R. Smith fig. 9785 (stainless steel type 316L)

3. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

   a. Olympic Manufacturing Group.
   b. Portals Plus, Inc.
   c. Thaler Metal Industries Ltd.
   d. Josam Company; Josam Div.

e. Marathon Roofing Products.
f. MIFAB, Inc.
g. Portals Plus, Inc.
h. Prier Products, Inc.
i. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
j. Tyler Pipe; Wade Div.
k. Watts Drainage Products Inc.
l. Zurn Plumbing Products Group; Light Commercial Operation.
m. Zurn Plumbing Products Group; Specification Drainage Operation.

4. Standard: ASME A112.21.2M.

5. Pattern: Roof drain.

6. Body Material: Stainless Steel Type 316L.

7. Combination Flashing Ring and Gravel Stop: Required.

8. Solid Water Dam, 3” High: Required.

9. Outlet: Side.

10. Grate Material: Stainless Steel Type 316L.

11. Extension Collars: Required.

12. Underdeck Clamp: Required.

2.4 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Expansion Joints

1. Standard: ASME A112.21.2M.

2. Body: Cast iron with bronze sleeve, packing, and gland.

3. End Connections: Matching connected piping.

4. Size: Same as connected piping.

2.5 FLASHING MATERIALS

A. Copper Sheet: ASTM B 152/B 152M, 12 oz./sq. ft. (3.7 kg/sq. m or 0.41-mm) thickness.

B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch (1.01-mm) minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if

indicated.

C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.

D. Fasteners: Metal compatible with material and substrate being fastened.

E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

F. Solder: ASTM B 32, lead-free alloy.

G. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.6 AREA DRAINS

A. Area Drain on 2nd Floor elevator platform

1. Manufacturers: products by one of the following:

2. Manufacturers: Subject to compliance with requirements, provide products similar to J. R. Smith fig. 1470

3. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

   a. Smith, Jay R. Mfg. Co.
   b. MIFAB, Inc.
   c. Watts Drainage Products Inc.
   d. Zurn Plumbing Products Group; Light Commercial Operation

4. Standard: ASME A112.6.3, for area drains.

5. Body Material: galvanized cast iron

6. Flange: Anchor with weep holes.

7. Clamping Device: Required.

8. Outlet: Bottom.

9. Grate Material: Ductile iron.

10. Grate Finish: Painted.

11. Top-Loading Classification: Heavy Duty

12. Option: Vandal Proof

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 15 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.

2. Locate at each change in direction of piping greater than 45 degrees.

3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.

4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.

F. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions. Roofing materials are specified in Division 7.

1. Install roof-drain flashing collar or flange so that there will be no leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.

2. Position roof drains for easy access and maintenance.

G. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

H. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

I. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished

locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.

2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.

3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221650

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SECTION 224460 - SUMP PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following sump pumps and accessories, inside the building, for building storm drainage systems:

1. Wet-pit-volute sump pumps.
2. Sump-pump basins and basin cover.
3. Packaged, submersible, oil-minder drainage pump unit in elevator pit.

B. Related sections include the following:

1. Division 15 Section “Storm Drainage Piping for Application in Storm Drainage System”.
2. Division 15 Section “Common Motor Requirements for Plumbing Equipment”.

1.3 SUBMITTALS

A. Product Data: For each type and size of sump pump specified. Include certified performance curves with operating points plotted on curves, and rated capacities of selected models, furnished specialties, and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For each sump pump to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of sump pumps and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined

in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's written rigging instructions for handling.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 WET-PIT-VOLUTE SUMP PUMPS

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:

B. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

1. Alyan Pump Company.

2. Armstrong Pumps Inc.

3. Chicago Pump Company; a division of Yeomans Chicago Corporation.

4. Federal Pump Corp.

5. Flo Fab inc.

6. PACO Pumps; Grundfos Pumps Corporation, U.S.A.

7. Peerless Pump, Inc.

8. Pentair Pump Group; Aurora Pump.

9. Swaby Manufacturing Company.

10. Tramco Pump Company.

11. Vertiflo Pump Company.

12. Weil Pump Company, Inc.

13. Weinman Division; Crane Pumps & Systems.

14. Yeomans Chicago Corporation.

C. Description: Factory-assembled and -tested sump-pump unit.

D. Pump Type: Wet-pit-volute, single-stage, separately-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.

E. Pump Casing: Cast iron, with strainer inlet and threaded connection for NPS 2 (DN 50) and smaller and flanged connection for NPS 2-1/2 (DN 65) and larger discharge piping.

F. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron design for clear wastewater handling, and keyed and secured to shaft.

G. Sleeve Bearings: Bronze. Include oil-lubricated, intermediate sleeve bearings at 48-inch (1200-mm) maximum intervals if basin depth is more than 48 inches (1200 mm), and grease-lubricated, ball-type thrust bearings.

H. Pump and Motor Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.

I. Pump Discharge Piping: Factory or field fabricated, galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.1, Class 125, cast- iron flanges and flanged fittings.

J. Support Plate: Cast iron or coated steel and strong enough to support pumps, motors, and controls. Refer to Part 2 "Sump-Pump Basins and Basin Covers" Article for requirements.

K. Shaft Seal: Stuffing box, with graphite-impregnated braided-yarn rings and bronze packing gland.

L. Motor: Single-speed; grease-lubricated ball bearings and mounting on vertical, cast-iron pedestal.

M. Controls:

1. Enclosure: NEMA 250, Type 1.

2. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.

3. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.

4. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).

5. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

N. Control-Interface Features:

1. Remote Alarm Contacts: For remote alarm interface.

2. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:

a. On-off status of pump.
b. Alarm status.

2.3 SUMP PUMP CAPACITIES AND CHARACTERISTICS: See “Equipment Schedule” at Drawing PO.2.

2.4 SUMP-PUMP BASINS AND BASIN COVERS

A. Basins: Factory-fabricated, watertight, cylindrical, basin sump with top flange and sidewall openings for pipe connections.

1. Material: Fiberglass.

2. Reinforcement: Mounting plates for pumps, fittings, and accessories.

3. Anchor Flange: Same material as or compatible with basin sump, cast in or attached to sump, in location and of size required to anchor basin in concrete slab.

B. Basin Covers: Fabricate metal cover with openings having gaskets, seals, and bushings; for access to pumps, pump shafts, control rods, discharge piping, vent connections, and power cables.

1. Reinforcement: Steel or cast iron, capable of supporting foot traffic for basins installed in foot-traffic areas.

2.5 PACKAGED DRAINAGE PUMP UNITS

A. Submersible Units: Factory-assembled and -tested, single-stage, centrifugal, end-suction, automatic-operation, submersible, drainage pump unit.

1. Available Manufacturers:

   a. ABS Pumps, Inc.
   b. Bell & Gossett Domestic Pump; ITT Industries.
   c. Goulds Pumps; ITT Industries.
   d. Grundfos Pumps Corp.
   e. Liberty Pumps.
   f. Little Giant Pump Co.
   g. McDonald, A. Y. Mfg. Co.
   h. Myers, F. E.; Pentair Pump Group (The).
   i. Sta-Rite Industries, Inc.
   j. Stancor Pump Co.

2. Pump Body: Cast iron

3. Impeller: Stainless Steel.

4. Pump Seals: Mechanical type.

5. Motor: Hermetically sealed, capacitor-start type, with built-in overload protection. Comply with requirements in Division 15 Section "Motors."

B. Sump Pump

1. The pump shall be a submersible type, capable of pumping up to 37' TDH and 15 GPM. The pump shall be approved to UL 778 standards and shall include thermal and overload protection. The motor shall be rated ½ H.P., 1 phase, 115V and capable of operating continuously or intermittently. The motor housing shall be constructed of cast iron with stainless steel rotor shaft, fasteners and removable bottom screen and mechanical seats shall be housed in a separate oil-filled compartment.

C. Pump Discharge Piping: Factory of field fabricated ASTM A-53, schedule 40, galvanized-steel pipe.

D. Control: The main control shall be approved to UL 508 standards and housed in a gasketed Nema 4X enclosure with a see-through window for observation of operating functions. The control shall be equipped with an 8-pin twist lock receptacle, an over current relay, self-cleaning stainless steel sensor probe, high decibel warning horn with alarm silencing switch, dual floats, clearly marked terminal board and remote monitoring contact. A Nema 4X junction box with 8-pin twist- lock electrical receptacle and 25' (additional lengths available in 25' increments) of mating 8 conductor cable shall be provided. All cable between the pump and junction box shall be 16' long and the cable and plug from the control unit shall be 8' long. The control unit, junction box, pump, floats and sensor shall be factory assembled as a complete, ready-to-use system and shall be tested and approved as a complete system by a nationally recognized

testing laboratory such as ENTELA. The system shall allow for the main control to be located outside of the elevator hoistway to be monitored for all functions without having to enter the elevator shaft.

2.6 BUILDING AUTOMATION SYSTEM INTERFACE

A. Provide auxiliary contacts in pump controllers for interface to building automation system. Include the following:

1. On-off status of each pump.

2. Alarm status.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of plumbing piping to verify actual locations of storm drainage piping connections before sump pump installation.

3.2 SUMP PUMP INSTALLATION

A. Install sump pumps according to applicable requirements in HI 1.4.

B. Install pumps and arrange to provide access for maintenance including removal of motors, impellers, couplings, and accessories.

C. Install sump pump basins and connect to drainage piping. Brace interior of basins according to manufacturer's written instructions to prevent distortion or collapse during concrete placement. Set basin cover and fasten to basin top flange. Install cover so top surface is flush with finished floor.

D. Construct sump pump pits and connect to drainage piping. Set pit curb frame recessed in and anchored to concrete. Fasten pit cover to pit curb flange. Install cover so top surface is flush with finished floor.

E. Install packaged, submersible, drainage pump unit basins on floor or concrete base unless recessed installation is indicated. Make direct connections to storm drainage piping.

F. Support piping so weight of piping is not supported by pumps.

3.3 CONNECTIONS

A. Piping installation requirements are specified in Division 15 Section "Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings,

and specialties.

B. Install piping adjacent to sump pumps to allow service and maintenance.

C. Connect storm drainage piping to pumps. Install discharge piping equal to or greater than size of pump discharge piping. Refer to Division 15 Section "Storm Drainage Piping."

1. Install flexible connectors adjacent to pumps in discharge piping.

2. Install check and shutoff valves on discharge piping from each pump. Install unions on pumps having threaded pipe connections. Install valves same size as connected piping. Refer to Division 15 Section "Valves" for general-duty valves for drainage piping.

D. Ground equipment according to Division 16 Section "Grounding and Bonding."

E. Connect wiring according to Division 16 Section "Conductors and Cables."

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

2. Verify bearing lubrication.

3. Disconnect couplings and check motors for proper direction of rotation.

4. Verify that each pump is free to rotate by hand. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.

5. Verify that pump controls are correct for required application.

B. Start pumps without exceeding safe motor power:

1. Start motors.

2. Open discharge valves slowly.

3. Check general mechanical operation of pumps and motors.

C. Test and adjust controls and safeties.

D. Remove and replace damaged and malfunctioning components.

1. Pump Controls: Set pump controls for automatic start, stop, and alarm operation as required for system application.

2. Set field-adjustable switches and circuit-breaker trip ranges as indicated, or if not indicated, for normal operation.

E. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION 224460

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SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

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SECTION 230518 - ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated and rough-brass finish and with concealed hinge and setscrew.

E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed and exposed-rivet hinge, and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of all exposed walls, ceilings, and finished floors.

B. No escutcheons required for concealed space, except that all openings shall be provided with proper fire seals to maintain the wall ratings, and sound sealed for noise transmission. Coordinate with the General Contractor as required.

C. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
g. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.

2. Escutcheons for Existing Piping:

a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
e. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated finish.
f. Bare Piping in Equipment Rooms: Split-casting brass type with polished, chrome-plated finish.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 230518

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SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND WORK REQUIREMENTS

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

B. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

C. Section 230548 "Vibration and Seismic Controls for HVAC" for vibration isolation devices.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.

2. Metal framing systems.

3. Fiberglass strut systems.

4. Pipe stands.

5. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

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

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.

3. Nonmetallic Coatings: Plastic coating, jacket, or liner.

4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.

2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Carpenter & Paterson, Inc.

2. Clement Support Services.

3. ERICO International Corporation.

4. National Pipe Hanger Corporation.

5. PHS Industries, Inc.

6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.

7. Piping Technology & Products, Inc.

8. Rilco Manufacturing Co., Inc.

9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened Portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.

F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

G. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

O. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
   b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
   c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
   d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
   e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

   2. Obtain fusion without undercut or overlap.

   3. Remove welding flux immediately.

   4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.3 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099113 "Exterior Painting" Section 099123 "Interior Painting" and Section 099600 "High Performance Coatings."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.5 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.

4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.

5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.

6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).

7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).

8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).

9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).

10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).

11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).

12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).

13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.

16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.

18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction might occur.

19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.

21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.

3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.

4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.

6. C-Clamps (MSS Type 23): For structural shapes.

7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.

8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.

11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).

c. Heavy (MSS Type 33): 3000 lb (1360 kg).

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.

2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).

3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.

4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.

5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.

6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.

8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

   a. Horizontal (MSS Type 54): Mounted horizontally.
   b. Vertical (MSS Type 55): Mounted vertically.
   c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

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SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Open-spring isolators.
5. Housed-spring isolators.
6. Restrained-spring isolators.
7. Housed-restrained-spring isolators.
8. Snubbers.
9. Restraint channel bracings.
10. Restraint cables.
11. Seismic-restraint accessories.
12. Mechanical anchor bolts.
13. Adhesive anchor bolts.
14. Restrained isolation roof-curb rails.

B. Related Requirements:

1. Section 210548 "Vibration and Seismic Controls for Fire Suppression" for devices for fire-suppression equipment and systems.

2. Section 220548 "Vibration and Seismic Controls for Plumbing" for devices for plumbing equipment and systems.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.

a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC- an agency acceptable to authorities having jurisdiction.
b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

3. Seismic Restraint Details:

a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacing's. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
d. Preapproval and Evaluation Documentation: By an evaluation service member of ICC an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Qualification Data: For professional engineer and testing agency.

C. Welding certificates.

D. Air-Mounting System Performance Certification: Include natural frequency, load, and damping test data performed by an independent agency.

E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-spring mounts and restrained-air-spring mounts to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

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

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC.

2. Assigned Seismic Use Group or Building Category as Defined in the IBC.

   a. Component Importance Factor
   b. Component Response Modification Factor.
   c. Component Amplification Factor.

3. Design Spectral Response Acceleration at Short Periods.

4. Design Spectral Response Acceleration at 1.0-Second Period.

5. Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

   a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they are subjected.

2.2 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Mason Industries, Inc.

2. Mounting Plates:

a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded.
b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.

3. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.3 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

A. Restrained Elastomeric Isolation Mounts.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Mason Industries, Inc.

2. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

a. Housing: Cast-ductile iron or welded steel.
b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.4 OPEN-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Mason Industries, Inc.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of the required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig.

7. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

2.5 HOUSED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Mason Industries, Inc.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of the required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.

   a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.

2.6 RESTRAINED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint.

1. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.

a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
b. Top plate with threaded mounting holes.
c. Internal leveling bolt that acts as blocking during installation.

2. Restraint: Limit stop as required for equipment and authorities having jurisdiction.

3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

4. Minimum Additional Travel: 50 percent of the required deflection at rated load.

5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.7 HOUSED-RESTRAINED-SPRING ISOLATORS

A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing.

1. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.

a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of the required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.8 SNUBBERS

A. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch air gap, and minimum 1/4-inch- thick resilient cushion.

2.9 RESTRAINT CHANNEL BRACING

A. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.10 RESTRAINT CABLES

A. Restraint Cables: ASTM A 492 stainless-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.11 SEISMIC RESTRAINT ACCESSORIES

A. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.

C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.12 MECHANICAL ANCHOR BOLTS

A. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.13 RESTRAINED ISOLATION ROOF-CURB RAILS

A. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand seismic and wind forces.

B. Upper Frame: The upper frame shall provide continuous support for equipment and shall be captive to resiliently resist seismic and wind forces.

C. Lower Support Assembly: The lower support assembly shall be formed sheet metal section containing adjustable and removable steel springs that support the upper frame. The lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly. Adjustable, restrained-spring isolators shall be mounted on elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.

D. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch thick.

E. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

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

3.2 APPLICATIONS

A. Hanger-Rod Stiffeners: Install hanger-rod stiffeners to receive them and where required to prevent buckling of hanger rods due to seismic forces.

B. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

B. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

C. Equipment Restraints:

1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.

2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.

3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.

4. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

5. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

6. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.

7. Set anchors to manufacturer's recommended torque, using a torque wrench.

8. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

2. Schedule test with Owner, through Engineer, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.

3. Test to 90 percent of rated proof load of device.

4. Measure isolator restraint clearance.

5. Measure isolator deflection.

6. Verify snubber minimum clearances.

7. Test and adjust restrained-air-spring isolator controls and safeties.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

END OF SECTION 230548

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.
5. Stencils.
6. Valve tags.
7. Warning tags.

1.3 ACTION SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

4. Fasteners: Stainless-steel rivets or self-tapping screws.

5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

2. Letter Color: White.

3. Background Color: Black.

4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

7. Fasteners: Stainless-steel rivets or self-tapping screws.

8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches high.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Brass.

2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.

3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.

2. Fasteners: Reinforced grommet and wire or string.

3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."

4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Section 099123 "Interior Painting."

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.

4. At access doors, manholes, and similar access points that permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.

7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Refrigerant Piping:

a. Background Color: Green.
b. Letter Color: White.

2. Cooling Condensate Piping:

a. Background Color: Green.
b. Letter Color: White.

3.4 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

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SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

   a. Constant-volume air systems.

2. Testing, adjusting, and balancing existing systems and equipment.

3. Sound tests.

4. Vibration tests.

5. Control system verification.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

E. TABB: Testing, Adjusting, and Balancing Bureau.

F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

1.4 PREINSTALLATION MEETINGS

A. Minimum Agenda Items:

1. The Contract Documents examination report.

2. The CERTIFIED TAB plan.

3. Needs for coordination and cooperation of trades and subcontractors.

4. Proposed procedures for documentation and communication flow.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 thirty days of Contractor's Notice to Proceed, submit documentation that the Certified TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 thirty days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. System Readiness Checklists: Within 30 thirty days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.

D. Certified TAB reports.

E. Sample report forms.

F. Instrument calibration reports, to include the following:

1. Instrument type and make.

2. Serial number.

3. Application.

4. Dates of use.

5. Dates of calibration.

1.6 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by NEBB.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB.

2. TAB Technician: Employee of the TAB specialist and certified by NEBB as a TAB technician.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.7 FIELD CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

A. Subject to compliance with requirements, engage one TAB specialists that may be engaged.

3.2 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine operating safety interlocks and controls on HVAC equipment.

K. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.3 PREPARATION

A. Prepare a TAB plan that includes the following:

1. Equipment and systems to be tested.

2. Strategies and step-by-step procedures for balancing the systems.

3. Instrumentation to be used.

4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
b. Duct systems are complete with terminals installed.
c. Volume, smoke, and fire dampers are open and functional.
d. Clean filters are installed.
e. Fans are operating, free of vibration, and rotating in correct direction.
f. Variable-frequency controllers' startup is complete and safeties are verified.
g. Automatic temperature-control systems are operational.
h. Ceilings are installed.
i. Windows and doors are installed.
j. Suitable access to balancing devices and equipment is provided.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in accordance with SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.

2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."

3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier.

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:

a. Measure static pressure directly at the fan outlet or through the flexible connection.
b. Measure static pressure directly at the fan inlet or through the flexible connection.
c. Measure static pressure across each component that makes up the air-handling system.
d. Report artificial loading of filters at the time static pressures are measured.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

4. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.

5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.

2. Adjust submain and branch duct volume dampers for specified airflow.

3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.

2. Measure inlets and outlets airflow.

3. Adjust each inlet and outlet for specified airflow.

4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.

2. Re-measure and confirm that total airflow is within design.

3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.

4. Mark all final settings.

5. Test system in economizer mode. Verify proper operation and adjust if necessary.

6. Measure and record all operating data.

7. Record final fan-performance data.

3.7 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.

2. Motor horsepower rating.

3. Motor rpm.

4. Phase and hertz.

5. Nameplate and measured voltage, each phase.

6. Nameplate and measured amperage, each phase.

7. Starter size and thermal-protection-element rating.

8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.8 SOUND TESTS

A. After the systems are balanced and construction is Substantially Complete, measure and record sound levels at locations as designated by the Engineer.

B. Instrumentation:

1. The sound-testing meter shall be a portable, general-purpose testing meter consisting of a microphone, processing unit, and readout.

2. The sound-testing meter shall be capable of showing fluctuations at minimum and maximum levels, and measuring the equivalent continuous sound pressure level (LEQ).

3. The sound-testing meter must be capable of using 1/3 octave band filters to measure mid-frequencies from 31.5 Hz to 8000 Hz.

4. The accuracy of the sound-testing meter shall be plus or minus one decibel.

C. Test Procedures:

1. Perform test at quietest background noise period. Note cause of unpreventable sound that affects test outcome.

2. Equipment should be operating at design values.

3. Calibrate the sound-testing meter prior to taking measurements.

4. Use a microphone suitable for the type of noise levels measured that is compatible with meter. Provide a windshield for outside or in-duct measurements.

5. Take sound readings in dBA and sound pressure levels in the eight un-weighted octave bands 63 Hz to 8000 Hz (NC) with the equipment operating.

6. Take readings no closer than 36 inches from a wall or from the operating equipment and approximately 60 inches from the floor, with the meter held or mounted on a tripod.

7. For outdoor measurements, move sound-testing meter slowly and scan area that has the most exposure to noise source being tested. Use A-weighted scale for this type of reading.

D. Reporting:

1. Report shall record the following:

   a. Location.
   b. System tested.
   c. dBA reading.
   d. Sound pressure level in each octave band with equipment on and off.

2. Plot sound pressure levels on NC worksheet with equipment on and off.

3.9 VIBRATION TESTS

A. Instrumentation:

1. Use portable, battery-operated, and microprocessor-controlled vibration meter with or without a built-in printer.

2. The meter shall automatically identify engineering units, filter bandwidth, amplitude, and frequency scale values.

3. The meter shall be able to measure machine vibration displacement in mils of deflection, velocity in inches per second, and acceleration in inches per second squared.

4. Verify calibration date is current for vibration meter before taking readings.

B. Test Procedures:

1. To ensure accurate readings, verify that accelerometer has a clean, flat surface and is mounted properly.

2. With the unit running, set up vibration meter in a safe, secure location. Connect transducer to meter with proper cables. Hold magnetic tip of transducer on top of the bearing, and measure unit in mils of deflection. Record measurement, then move transducer to the side of the bearing and record in mils of deflection. Record an axial reading in mils of deflection by holding nonmagnetic, pointed transducer tip on end of shaft.

3. Change vibration meter to velocity (inches per second) measurements. Repeat and record above measurements.

4. Record CPM or rpm.

5. Read each bearing on motor, fan, and pump as required. Track and record vibration levels from rotating component through casing to base.

C. Reporting:

1. Report shall record location and the system tested.

2. Include horizontal-vertical-axial measurements for tests.

3. Verify that vibration limits follow Specifications, or, if not specified, follow the General Machinery Vibration Severity Chart or Vibration Acceleration General Severity Chart from the AABC National Standards. Acceptable levels of vibration are normally "smooth" to "good."

4. Include in report General Machinery Vibration Severity Chart, with conditions plotted.

3.10 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify temperature control system is operating within the design limitations.

2. Confirm that the sequences of operation are in compliance with Contract Documents.

3. Verify that controllers are calibrated and function as intended.

4. Verify that controller set points are as indicated.

5. Verify the operation of lockout or interlock systems.

6. Verify the operation of valve and damper actuators.

7. Verify that controlled devices are properly installed and connected to correct controller.

8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.

9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.11 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan.

2. Measure motor voltage and amperage. Compare the values to motor nameplate information.

3. Check the refrigerant charge.

4. Check the condition of filters.

5. Check the condition of coils.

6. Check the operation of the drain pan and condensate-drain trap.

7. Check bearings and other lubricated parts for proper lubrication.

8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:

1. New filters are installed.

2. Coils are clean and fins combed.

3. Drain pans are clean.

4. Fans are clean.

5. Bearings and other parts are properly lubricated.

6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.

2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.

3. If calculations increase or decrease the airflow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.

4. Balance each air outlet.

3.12 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.

2. Air Outlets and Inlets: Plus or minus 10 percent.

END OF SECTION 230593

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SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Condensate drain piping, indoors and outdoors.

2. Refrigerant suction and hot-gas piping, indoors and outdoors

B. Related Sections:

1. Section 232300 "Refrigerant Piping."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.

2. Detail attachment and covering of heat tracing inside insulation.

3. Detail insulation application at pipe expansion joints for each type of insulation.

4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.

5. Detail removable insulation at piping specialties.

6. Detail application of field-applied jackets.

7. Detail application at linkages of control devices.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use.

1. Preformed Pipe Insulation Materials: 12 inches (300 mm) long by NPS 2 (DN 50).

2. Sheet Form Insulation Materials: 12 inches (300 mm) square.

3. Jacket Materials for Pipe: 12 inches (300 mm) long by NPS 2 (DN 50).

4. Sheet Jacket Materials: 12 inches (300 mm) square.

5. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. If retaining "Mockups" Paragraph below, indicate location, size, and other details of mockups on Drawings or by inserts. Revise if only one mockup is required.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Pittsburgh Corning Corporation; Foamglas.
b. <Insert manufacturer's name; product name or designation>.

2. Block Insulation: ASTM C 552, Type I.

3. Special-Shaped Insulation: ASTM C 552, Type III.

4. Board Insulation: ASTM C 552, Type IV.

5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.

6. Preformed Pipe Insulation with Factory-Applied ASJ ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.

7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Aeroflex USA, Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
d. <Insert manufacturer's name; product name or designation>.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

1. Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.
b. <Insert manufacturer's name; product name or designation>.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Aeroflex USA, Inc.; Aeroseal.
b. Armacell LLC; Armaflex 520 Adhesive.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
d. K-Flex USA; R-373 Contact Adhesive.
e. <Insert manufacturer's name; product name or designation>.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
b. - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
d. Mon-Eco Industries, Inc.; 22-25.
e. <Insert manufacturer's name; product name or designation>.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
b. - Marathon Industries; 405.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
d. Mon-Eco Industries, Inc.; 44-05.
e. Pittsburgh Corning Corporation; Pittseal 444.
f. <Insert manufacturer's name; product name or designation>.

2. Joint Sealants for Polystyrene Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-70.
b. - Marathon Industries; 405.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
d. Mon-Eco Industries, Inc.; 44-05.
e. <Insert manufacturer's name; product name or designation>.

3. Materials shall be compatible with insulation materials, jackets, and substrates.

4. Permanently flexible, elastomeric sealant.

5. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).

6. Color: White or gray.

7. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

8. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. ABI, Ideal Tape Division; 428 AWF ASJ.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
c. Compac Corporation; 104 and 105.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
e. <Insert manufacturer's name; product name or designation>.

2. Width: 3 inches (75 mm).

3. Thickness: 11.5 mils (0.29 mm).

4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.

5. Elongation: 2 percent.

6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.

7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

C. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. ABI, Ideal Tape Division; 491 AWF FSK.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
c. Compac Corporation; 110 and 111.
d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
e. <Insert manufacturer's name; product name or designation>.

2. Width: 3 inches (75 mm).

3. Thickness: 6.5 mils (0.16 mm).

4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.

5. Elongation: 2 percent.

6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.

7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

D. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. ABI, Ideal Tape Division; 370 White PVC tape.
b. Compac Corporation; 130.
c. Venture Tape; 1506 CW NS.
d. <Insert manufacturer's name; product name or designation>.

2. Width: 2 inches (50 mm).

3. Thickness: 6 mils (0.15 mm).

4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.

5. Elongation: 500 percent.

6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

E. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. ABI, Ideal Tape Division; 488 AWF.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
c. Compac Corporation; 120.
d. Venture Tape; 3520 CW.
e. <Insert manufacturer's name; product name or designation>.

2. Width: 2 inches.

3. Thickness: 3.7 mils.

4. Adhesion: 100 ounces force/inch in width.

5. Elongation: 5 percent.

6. Tensile Strength: 34 lbf/inch in width.

F. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Dow Chemical Company (The); Saran 540 Vapor Retarder Tape.
b. <Insert manufacturer's name; product name or designation>.

2. Width: 3 inches.

3. Film Thickness: 4 mils.

4. Adhesive Thickness: 1.5 mils.

5. Elongation at Break: 145 percent.

6. Tensile Strength: 55 lbf/inch (10.1 N/mm) in width.

2.4 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. ITW Insulation Systems; Gerrard Strapping and Seals.
b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
c. <Insert manufacturer's name; product name or designation>.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) 3/4 inch (19 mm) wide with wing seal or closed seal.

3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) 3/4 inch (19 mm) wide with wing seal or closed seal.

4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

C. Wire: 0.080-inch (2.0-mm) nickel-copper alloy 0.062-inch (1.6-mm) soft-annealed, stainless steel 0.062-inch (1.6-mm) soft-annealed, galvanized steel.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. C & F Wire.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.

2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick and an epoxy finish 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) 4 inches (100 mm) o.c.

a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.

2. Testing agency labels and stamps.

3. Nameplates and data plates.

4. Manholes.

5. Handholes.

6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring

indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).

4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping".

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.

4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.

4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.

2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.

2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.

4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.

2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three <Insert number> locations of straight pipe, three <Insert number> locations of threaded fittings, three <Insert number> locations of welded fittings, two <Insert number> locations of threaded strainers, two <Insert number> locations of welded strainers, three <Insert number> locations of threaded valves, and three <Insert number> locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.

2. Underground piping.

3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 3/4 inch (19 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
c. Polyolefin: 3/4 inch (19 mm) 1 inch (25 mm) <Insert dimension> thick.

B. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 1 inch thick.

3.11 OUTDOOR, ABOVE GROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric with aluminum metal jacket: 1 inch thick.

END OF SECTION 230719

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Refrigerant pipes and fittings.
2. Refrigerant piping valves and specialties.
3. Refrigerants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty.

1. Include pressure drop, based on manufacturer's test data, for the following:

a. Thermostatic expansion valves.
b. Solenoid valves.
c. Hot-gas bypass valves.
d. Filter dryers.
e. Strainers.
f. Pressure-regulating valves.

B. Shop Drawings:

1. Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes; flow capacities; valve arrangements and locations; slopes of horizontal runs; wall and floor penetrations; and equipment connection details.
2. Shop Drawing Scale: 1/4 inch equals 1 foot.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to 2010 ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.7 PRODUCT STORAGE AND HANDLING

A. Store piping with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 550 psig.

2. Suction Lines for Heat-Pump Applications: 550 psig.

3. Hot-Gas and Liquid Lines: 550 psig.

2.2 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type K or L, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: not allowed.

E. Brazing Filler Metals: AWS A5.8/A5.8M.

2.3 VALVES AND SPECIALTIES

A. Check Valves:

1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.

2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.

3. Piston: Removable polytetrafluoroethylene seat.

4. Closing Spring: Stainless steel.

5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.

6. End Connections: Socket, union, threaded, or flanged.

7. Maximum Opening Pressure: 0.50 psig.

8. Working Pressure Rating: 500 psig.

9. Maximum Operating Temperature: 275 deg F.

B. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.

2. Core: Removable ball-type check valve with stainless-steel spring.

3. Seat: Polytetrafluoroethylene.

4. End Connections: Copper spring.

5. Working Pressure Rating: 500 psig.

C. Safety Relief Valves: Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.

1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.

2. Piston, Closing Spring, and Seat Insert: Stainless steel.

3. Seat: Polytetrafluoroethylene.

4. End Connections: Threaded.

5. Working Pressure Rating: 400 psig.

6. Maximum Operating Temperature: 240 deg F.

D. Straight-Type Strainers:

1. Body: Welded steel with corrosion-resistant coating.

2. Screen: 100-mesh stainless steel.

3. End Connections: Socket or flare.

4. Working Pressure Rating: 500 psig.

5. Maximum Operating Temperature: 275 deg F.

E. Angle-Type Strainers:

1. Body: Forged brass or cast bronze.

2. Drain Plug: Brass hex plug.

3. Screen: 100-mesh monel.

4. End Connections: Socket or flare.

5. Working Pressure Rating: 500 psig.

6. Maximum Operating Temperature: 275 deg F.

2.4 REFRIGERANTS

A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.

B. Suction Lines NPS 3-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR Type K, drawn-temper tubing and wrought-copper fittings with brazed joints.

C. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

D. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

E. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications:

1. NPS 5/8 (DN 18) and Smaller: Copper, Type ACR, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

2. NPS 3/4 to NPS 1 and Smaller: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

F. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

G. Safety-Relief-Valve Discharge Piping: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

H. Safety-Relief-Valve Discharge Piping:

1. NPS 5/8 and Smaller: Copper, Type ACR, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

2. NPS 3/4 to NPS 1 and Smaller: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

B. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

C. Install a full-size, three-valve bypass around filter dryers.

D. Install safety relief valves where required by 2010 ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

E. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for the device being protected:

1. Solenoid valves.

2. Thermostatic expansion valves.

3. Hot-gas bypass valves.

4. Compressor.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. Install refrigerant piping in protective conduit where installed belowground.

M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

N. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.

2. Install horizontal suction lines with a uniform slope downward to compressor.

3. Install traps and double risers to entrain oil in vertical runs.

4. Liquid lines may be installed level.

O. When brazing, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

P. Before installation of steel refrigerant piping, clean pipe and fittings using the following procedures:

1. Shot blast the interior of piping.

2. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through tubing by means of a wire or electrician's tape.

3. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.

4. Draw a clean, lintless cloth, saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.

5. Finally, draw a clean, dry, lintless cloth through the tube or pipe.

6. Safety-relief-valve discharge piping is not required to be cleaned but is required to be open to allow unrestricted flow.

Q. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

R. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.

2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

3.5 HANGERS AND SUPPORTS

A. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.

2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.

3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.

4. Spring hangers to support vertical runs.

5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:

1. NPS 1/2: Maximum span, 60 inches; minimum rod, 1/4 inch.

2. NPS 5/8: Maximum span, 60 inches; minimum rod, 1/4 inch.

3. NPS 1: Maximum span, 72 inches; minimum rod, 1/4 inch.

4. NPS 1-1/4: Maximum span, 96 inches; minimum rod, 3/8 inch.

5. NPS 1-1/2: Maximum span, 96 inches; minimum rod, 3/8 inch.

6. NPS 2: Maximum span, 96 inches; minimum rod, 3/8 inch.

7. NPS 2-1/2: Maximum span, 108 inches; minimum rod, 3/8 inch.

D. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Comply with ASME B31.5, Chapter VI.

2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.

3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.

a. Fill system with nitrogen to the required test pressure.
b. System shall maintain test pressure at the manifold gage throughout duration of test.
c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.

d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

B. Prepare test and inspection reports.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.

2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.

3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.

4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.

2. Verify that compressor oil level is correct.

3. Open compressor suction and discharge valves.

4. Open refrigerant valves except bypass valves that are used for other purposes.

5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

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SECTION 233423 - POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Centrifugal wall ventilators.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on sea level.

B. Operating Limits: Classify according to AMCA 99.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:

1. Certified fan performance curves with system operating conditions indicated.

2. Certified fan sound-power ratings.

3. Motor ratings and electrical characteristics, plus motor and electrical accessories.

4. Material thickness and finishes, including color charts.

5. Dampers, including housings, linkages, and operators.

6. Fan speed and temperature controllers.

B. Shop Drawings: 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. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Roof framing and support members relative to duct penetrations..

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.8 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.9 COORDINATION

A. Coordinate size and location of structural-steel support members.

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

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL WALL VENTILATORS

A. General Description:

1. Discharge air directly away from the mounting surface.
2. Sidewall mounted applications
3. Performance capabilities up to 4,000 cubic feet per minute (cfm) and static pressure to 0.5 inches of water gauge.
4. Maximum continuous operating temperature is 400 Fahrenheit.
5. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number

B. Wheel:

1. Material Type: Aluminum
2. Non-overloading, backward inclined centrifugal wheel
3. Statically and dynamically balanced in accordance to AMCA Standard 204-05
4. The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency

C. Motors:

1. Electronically Commutated Motor

a. Motor enclosure: Open drip proof

b. Motor to be a DC electronic commutation type motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable. Examples of unacceptable motors are: Shaded Pole, Permanent Split Capacitor (PSC), Split Phase, Capacitor Start and 3 phase induction type motors

c. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase

d. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor

e. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed Control to be a packaged indoor air quality control designed to regulate fan speed based on level of temperature and/or relative humidity in a space. Control shall include a

Proportional Integral Derivative (PID) feedback loop and shall have labeled terminal strips for easy wiring. Fan shall be direct drive including an electronic commutation (EC) Vari-Green Motor. Control package shall be Vari-Green Indoor Air Quality – Temperature / Humidity Control.

f. Motor shall be a minimum of 85% efficient at all speeds

D. Housing:

1. Constructed of heavy gauge aluminum includes exterior housing, curb cap, windband, and motor compartment housing. Galvanized material is not acceptable
2. Housing shall have a rigid internal support structure
3. Windband to be one piece uniquely spun aluminum construction and maintain original material thickness throughout the housing
4. Windband to include an integral rolled bead for strength
5. Breather tube shall be 10 square inches in size for fresh air motor cooling, and designed to allow wiring to be run through it
6. Leak Resistant
7. Continuously welded seam
8. Steel mounting plate and integral venturi attached to windband

E. Motor Cover:

1. Constructed of aluminum

F. Vibration Isolation:

1. Sized to match the weight of each fan

G. Disconnect Switches:

1. NEMA rated: NEMA 1: indoor application no water. Factory standard.
2. Positive electrical shut-off
3. Wired from fan motor to junction box installed within motor compartment

H. Drain Trough:

1. Allows for one-point drainage of water, grease, and other residues

I. Options/Accessories:

1. Birdscreen:

a. Material Type: Aluminum
b. Protects fan discharge

2. Dampers:

a. Type: WD-323, 115 VAC
b. Prevents outside air from entering back into the building when fan is off
c. Balanced for minimal resistance to flow
d. Galvanized frames with prepunched mounting holes

J. Accessories:

1. Vari-Green Motor

2. Vari-Green Indoor Air Quality – Temperature/Humidity Control Package

3. Dial on Motor

4. 115/230 VAC to 24 VDC Transformer – Mounted and Wired

5. NEMA-3R Toggle Switch

6. Junction Box, Mounted and Wired

7. Damper

8. Damper Actuator

9. Birdscreen

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

B. Enclosure Type: Totally enclosed, fan cooled.

2.3 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210,

"Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Equipment Mounting:

1. Comply with requirements for vibration isolation devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

C. Secure roof-mounted fans to steel framing with cadmium-plated hardware. See Section 077200 "Roof Accessories" for installation.

D. Install units with clearances for service and maintenance.

E. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Drawings indicate general arrangement of equipment and accessories.

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Section 260519 "Low Voltage Electrical pervvConductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.

2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that

proper thermal-overload protection is installed in motors, starters, and disconnect switches.

3. Verify that cleaning and adjusting are complete.

4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system.

5. Adjust damper linkages for proper damper operation.

6. Verify lubrication for bearings and other moving parts.

7. Verify that manual and automatic volume control.

8. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.

9. Shut unit down and reconnect automatic temperature-control operators.

10. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Section 15950 "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.

C. Lubricate bearings.

END OF SECTION 233423

***

SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONERS

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 variable refrigerant flow (VRF) split-system air-conditioning and heat-pump unit consisting of separate evaporator-fan and compressor-condenser components.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. The VRF manufacturer shall provide published outdoor unit performance data in table format which states the products heating and cooling capacity expressed in British thermal units per hour (BTUH) and power consumption expressed in kilowatts (kW) at a minimum of 8 possible combinations of allowed conditions between 50% and 130% connection ratio. Possible combinations of allowed condition variables include Combination Ratios expressed as a percentage value, Outdoor Ambient Temperature expressed in degrees Fahrenheit (°F), and indoor unit Entering Air wet and dry bulb temperature expressed in degrees Fahrenheit (°F). Any product whose system design and engineering manuals or guides where published data tables are expressed in units other than these specified will not be accepted.

C. Any product whose published documentation requires the design engineer to apply a correction factor derived from a published curve or tabular data for combination ratio, outdoor ambient temperature, and/or entering air temperature against rated conditions to obtain performance at any possible combination of allowed conditions will not be accepted.

D. Submittals: a complete submittal package shall be complied and 10 copies shall be forwarded to the general contractor who shall supply the architect with the submittals for dissemination to all parties. The submittal shall be a collection of documents that represent the technical aspects of each product or collection of products to be used on

the project. All performance submissions shall be calculated at the design temperatures, nominal performance data shall not be allowed. The submission and approval of said submittals does not relieve the contractor of supplying all requirements set forth in the specification and drawings. Any substitutions offered by the contractor shall include, as a separate document, any and all differences between the submitted products and the specified products including but not limited to, all dimensions, electrical, control, weights, warranties, country of origin and a statement from the manufacture that no child labor has been used in the manufacture or assembly of said products and a copy shall be supplied with the product outdoor unit submittal.

E. If submittals contain any proposed alternate equipment specifications, calculations, dimensions, electrical specifications, sound specifications or any other mandated submission which are not accepted, are noted or rejected for any reason the contractor shall be allowed to correct any deficiency and re-submit a second time. Should there be any issues found on second submission the contractor will be directed to and agrees to submit on the original specified products and provide the specified products without any additional compensation.

F. Shop Drawings: 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. Wiring Diagrams: For power, signal, and control wiring.

G. Samples for Initial Selection: For units with factory-applied color finishes.

1.4 STANDARDS/CERTFICATIONS

A. LG Multi V IV VRF heat pump systems shall have published performance ratings certified by AHRI (Air-Conditioning, Heating, and Refrigeration Institute) and listed in the AHRI Standard 1230 certified product directory.

B. All VRF heat pump system components shall be manufactured in production facilities maintaining the following ISO certifications:

1. ISO 9001 Quality Management System
2. ISO 14001 Environmental Management System

C. All VRF heat pump system components shall comply with Underwriters Laboratories (UL) 1995 4th edition of Heating and Cooling Equipment Standard for Safety and bear the Electrical coppering Laboratories (ETL) mark.

D. All–VRF heat pump system electrical power wiring shall be installed according to National Electrical Code (NEC) or applicable state and local building codes.

1.5 LIMITED WARRANTY

A. Standard one-year parts limited warranty for a qualified system. The Parts are warranted for a period of one (1) year from the date of original purchase.

B. Provide extended parts limited warranty for a system installed by a contractor who has successfully completed LG service training courses with a complete commissioning report approved by LG.

C. Provide additional nine (9) year parts and compressor LG Excellence Contractor limited warranty. The parts and compressor part are warranted for an additional nine (9) year period from the second (2nd) through the tenth (10th) year after the date of original purchase for recognized LG Excellence Contractors.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set for each air-handling unit.
2. Gaskets: set for each access door.

1.8 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.9 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. LG Electronics.

B. Mitsubishi

C. Fujitsu

2.2 INDOOR UNIT

A. The indoor unit shall be capable of the following ambient operating range:

1. Cooling: 53°F DB to 75°F WB
2. Heating: 60°F WB to 86°F DB

B. General

1. Unit shall be factory assembled, wired, piped and run tested.
2. Unit shall be designed to be installed for indoor application.
3. Unit shall be attached to an installation plate/bracket that secures unit to the wall.
4. The depth of the unit shall not exceed 10 inches.

C. Casing/Panel

1. Unit case shall be manufactured of heavy duty Acrylonitrile Butadiene Styrene (ABS) and High Impact Polystyrene (HIPS) plastic.
2. Unit case shall have a pearl white finish.
3. The front surface of the unit shall have an architectural curved panel with pearl white finish.

D. Cabinet Assembly

1. Unit shall have one supply air outlet and one return air inlet.
2. Unit shall be equipped with factory installed temperature thermistors for

a. Return air
b. Refrigerant entering coil
c. Refrigerant leaving coil

3. Unit shall have a built-in control panel to communicate with the outdoor unit.
4. Unit shall have the following functions as standard:

a. Self-diagnostic function
b. Auto restart function
c. Auto changeover function
d. Auto clean function
e. Dehumidifying function
f. Hot Start
g. Sleep mode

5. Unit shall be capable of refrigerant piping in 4 different directions.
6. Unit shall be capable of drain piping in 2 different directions.

E. Fan Assembly

1. The unit shall have a direct drive, cross flow fan made of high strength ABS plastic.
2. The fan motor is Brushless Digitally controlled (BLDC) with permanently lubricated and sealed ball bearings.
3. The fan/motor assembly shall be mounted on vibration attenuating rubber grommets.
4. The fan speed shall be controlled using microprocessor based direct digitally controlled algorithm.
5. In cooling mode, the indoor fan shall have the following settings: Low, Med, High, Power Cool, and Auto.
6. In heating mode, the indoor fan shall have the following settings: Low, Med, High, Power Heat, and Auto.
7. The Auto fan setting shall adjust the fan speed to most effectively achieve the set-point.
8. Unit shall have factory installed motorized louver to provide flow of air in up and down direction for uniform airflow.
9. Unit shall have factory installed motorized guide vane to control the direction of flow of air from side to side.

F. Filter Assembly

1. The return air inlet shall have a factory supplied primary removable, washable filter.
2. The unit shall be equipped with factory supplied secondary 3M HAF Filter.
3. The filter access shall be from the front of the unit.

G. Coil Assembly

1. Unit shall have a factory built coil comprised of aluminum fins mechanically bonded on copper tubing.
2. Unit shall have minimum of 2 rows of coils.
3. Unit shall have a factory supplied condensate drain pan below the coil.
4. Unit shall be designed for gravity drain.
5. Unit shall have a factory insulated drain hose to handle condensate.
6. Unit shall have provision of 45° flare refrigerant pipe connections
7. The coil shall be factory pressure tested at a minimum of 551 psig.
8. All refrigerant piping from outdoor unit to indoor unit shall be field insulated.

H. Condensate Sensor Connection

1. The unit shall include a factory installed condensate sensor connection compatible with the AquaGuard® AG-9300-LG condensate sensor.

I. Microprocessor Control

1. The unit shall have a factory installed microprocessor controller capable of performing functions necessary to operate the system.
2. The unit shall be able to communicate with the outdoor unit using a field supplied minimum of 18 AWG, 4 conductor, stranded, shielded or unshielded power/communication cable. If shielded, it must be grounded to chassis at ODU only.
3. Central control shall be available through an optional control board for the outdoor unit.
4. The unit shall be capable of setting Cooling Only operation.
5. The unit controls shall operate the indoor unit using one of the five operating modes:
   a. Auto changeover
   b. Heating
   c. Cooling
   d. Dry
   e. Fan only

J. Electrical

1. The unit electrical power shall be 208-230/1/60 (V/Ph/Hz)
2. The unit shall be capable of operating within voltage limits of +/- 10% of the rated voltage.

K. Controls

1. The indoor unit shall be supplied with a wireless handheld controller.
2. An optional wired controller shall be available as an additional accessory.
3. An optional Wi-Fi module shall be available as an additional accessory to allow monitoring and control through a smart phone with the LG Smart AC application.

2.3 OUTDOOR UNITS

A. The outdoor unit shall be capable of the following ambient operating range:

1. Cooling: 0°F DB to 118°F DB with optional low ambient kit.
2. Heating: -13°F WB to 65°F WB

B. General:

1. Unit shall be manufactured by LG or approved equal.
2. The air-conditioning system shall use R410A refrigerant.
3. The system shall have one air source outdoor unit.
4. The refrigerant circuit shall be field piped to a single matching indoor unit to effectively and efficiently control the heating or cooling operation of the system.
5. All refrigerant piping from outdoor unit to indoor unit shall be field insulated.
6. Factory installed microprocessor controls in the outdoor unit and indoor unit shall perform functions to efficiently operate the single zone system and communicate via minimum 18 AWG, 4 conductor, stranded, shielded or unshielded power/communication cable. If shielded, it must be grounded to chassis at ODU only.
7. The outdoor unit shall be internally assembled, wired and piped from the factory.
8. The factory assembled system shall have the outdoor unit fitted with refrigerant strainer, check valves, oil separator, accumulator, 4-way reversing valve, electronic expansion valve, high side and low side refrigerant charging ports, and a service port.

C. Piping Capabilities:

1. The outdoor unit shall be capable of operating at an elevation of 22.9 feet above or below the indoor units.
2. The outdoor unit shall be capable of operating with up to 49.2 feet of total equivalent refrigerant piping length.

D. Defrost Operations

1. The outdoor unit shall be capable of auto defrost operation to melt accumulated ice off the outdoor unit heat exchanger. The defrost cycle control shall be based on outdoor ambient temperatures and outdoor unit heat exchanger temperatures.

E. Oil Management

1. The outdoor unit shall have an oil injection mechanism to ensure a consistent film of oil on all moving compressor parts at low speed.
2. The outdoor unit shall have an oil separator to separate oil mixed with the refrigerant gas during compression and return oil to the compressor.

F. Cabinet

1. The outdoor unit cabinet shall be made of pre-coated metal (PCM).

2. The front/side panels of the outdoor unit shall be removable type for access to internal components.
3. Outdoor unit cabinet shall be tested in accordance with ASTM B-117 salt spray test procedure for a minimum of 1000 hours.

G. Fan Assembly

1. The outdoor unit shall be equipped with one direct drive variable speed propeller fan with Brushless Digitally Controlled (BLDC) motor with a horizontal air discharge.
2. The fan blades shall be made of Acrylonitrile Butadiene Styrene (ABS) material.
3. The fan shall be equipped with permanently lubricated bearings.
4. The fan motor shall have variable speed to a maximum of 950 RPM.
5. The fan shall have a raised guard to help prevent contact with moving parts.

H. Outdoor Coil

1. The outdoor unit shall have a factory built coil comprised of aluminum fins mechanically bonded on copper tubing.
2. The aluminum fins shall have factory applied corrosion resistant GoldFin™ material.
3. Coil coating shall be tested in accordance with ASTM B-117 salt spray test procedure for a minimum of 1000 hours.
4. The outdoor unit coil shall be factory tested to a pressure of 600 psig.
5. The coil for each outdoor unit shall have a minimum of 14 Fins per Inch (FPI).
6. The coil for each outdoor unit shall have a 2 row heat exchanger.
7. The outdoor unit cabinet shall have a coil guard.

I. Compressor

1. Each 3/4 to 1 ton outdoor unit shall be equipped with one hermetically sealed, digitally controlled, inverter driven single-rotary compressor with vibration isolation.
2. Each 1.5 to 3 ton outdoor unit shall be equipped with one hermetically sealed, digitally controlled, inverter driven twin-rotary compressor.
3. The compressor shall be mounted on vibration attenuating rubber grommets.
4. The compressor shall use a factory charge of Polyvinyl Ether (PVE) oil.
5. The compressor bearing(s) shall have Teflon™ coating.
6. The compressor shall be equipped with over-current protection.

J. Sound Levels

1. The outdoor unit shall have sound levels not exceeding 57 dB(A) tested in an anechoic chamber under ISO1996 standard.

K. Sensors

1. The outdoor unit shall have
   a. Suction temperature sensor

b. Discharge temperature sensor
c. High pressure sensor
d. Low Pressure sensor
e. Outdoor temperature sensor
f. Outdoor unit heat exchanger temperature sensor

2.4 CONTROLS

A. Overview:

1. The Simple Remote Controller for Multi V™ shall be capable of monitoring and controlling up to 16 indoor units. The Simple Remote Controller shall be capable of controlling the group in terms of On/Off, Mode of Operation, Fan Speed, and space temperature set point based on the available functions of the connected system. Additionally, the Simple Remote Controller Remote Controller will be available with Mode of Operation control, and offered in two colors, black or white.

B. General:

1. The Simple Remote Controller shall be compatible with LG Multi V™ VRF indoor unit.
2. The Simple Remote Controller shall communicate to the VRF indoor unit via included communications cable.
3. The Simple Remote Controller shall be approximately 2-3/4” W x 4-3/4” H x 9/16” D in size.
4. The Simple Remote Controller shall have an internal infrared receiver for use with the Handheld Wireless Remote Controller for LG Multi V™ VRF systems.
5. The Simple Remote Controller shall be able to display temperature in °F or °C based on user settings.
6. The Simple Remote Controller shall be able to monitor and control up to sixteen indoor units (one group) as a single zone.
7. Up to two Simple Remote Controllers shall be connectable to a single group and operate in a master/slave configuration.
8. The Simple Remote Controller shall be shipped with a communications cable for connection to LG Multi V™ VRF indoor units.

C. Basic Functions:

Function	Description	Monitor	Control
On/Off	On/Off operation for group	X	X
Mode of Operation**	Mode of Operation for group (Heat/Cool/Fan/Dry/Auto)	X	X
Set Point	Space temperature set point for group. Setting temperature range 64°F-84°F depending on operation mode and connected equipment.	X	X
Space Temperature	Display measured space temperature	X	

Fan Speed	Select fan speeds	X	X

D. Electrical:

1. The Simple Remote Controller shall be powered via the LG Multi V™ VRF indoor units.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof-mounted, compressor-condenser components on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

D. Equipment Mounting:

1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base. Comply with requirements for equipment bases and foundations.
2. Install ground-mounted, compressor-condenser components on polyethylene mounting base.
3. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

E. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238126

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SECTION 238313 - SNOW MELTING ELECTRIC HEATING CABLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Snow melting cables.

B. Control unit for snow melting cable.

C. Components and accessories for a complete operating snow melting system.

1.2 RELATED SECTIONS

A. Section 033000 – Cast-In-Place Concrete.

B. Section 260600 – Schedules for Electrical: Materials and installation of wiring and electrical power source.

C. Section 320630 – Sidewalks: Installation coordination with concrete pavements.

D. Section 321400 – Unit Paving: Installation coordination with unit pavers.

1.3 PERFORMANCE REQUIREMENTS

A. Snow Melting Installations: Nominal watts/square foot: Pedestrian Area 55 W/SF., Vehicle Area 45 W/SF.

1.4 REFERENCES

A. Underwriter's Laboratories (UL) – Directory of UL Listed Products

B. Canadian Standards Association (CSA)

C. National Electric Code (NEC): – Article 426 Fixed Outdoor Electric Deicing and Snow-Melting Equipment.

1.5 SUBMITTALS

A. Submit under provisions of Section 013000.

B. Manufacturer's product data sheets

C. Manufacturer's installation instructions

1.6 PROJECT RECORD DOCUMENTS

A. Accurately record locations of heating cable, temperature and moisture sensors, thermostats and branch circuit connections.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Minimum 5 years' experience in design, engineering, manufacture and support of specified system and components

B. Product Requirements

1. All snow melting equipment furnished under this section shall be supplied by a single manufacturer.

2. UL Listed and CSA Certified MI snow melting cables.

3. Snow Melting Mats shall be identified as being suitable for the chemical, thermal, and physical environment, and installed per manufacturers drawings and instructions.

4. Automatic snow melting control with continuous monitoring of ambient temperature, slab temperature, and slab moisture.

5. Self Regulating cable is not acceptable for this application.

6. Glycol based systems are not acceptable for this application.

7. MI snow melting cable shall be factory assembled, immersed in water for a minimum of 12 hours, and then tested for insulation resistance, high potential breakdown, and continuity before leaving the factory.

1.8 COORDINATION

A. Coordinate installation of heating cable with Electrical Contractor, Concrete, Asphalt or Paving Contractor, and General Contractor.

B. Coordinate installation of heating cable with installation of concrete framework and concrete placement.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. System shall be manufactured by:

Delta-Therm Corporation, 6711 Sands Rd Suite A, Crystal Lake, IL 60014, Phone: 800-526-7887, Fax: 847-526-4456, Email: info@Delta-Therm.com, Web: www.Delta-Therm.com

B. Substitutions: No substitutions are permitted.

2.2 HEATING CABLE

A. Mineral Insulated (MI) Heating Cable:

1. UL Listed and CSA Certified Mineral Insulated (MI), seamless sheathed, series resistance heating cable.

2. MI heating cable construction shall consist of MI copper sheath or MI stainless steel sheath, terminated in factory splice to stranded wire connection leads.

3. MI copper sheath heating cable construction shall consist of MI copper sheath and have a high density polyethylene jacketing (HDPE) to provide extra corrosion and mechanical protection.

4. Connection leads shall be of sufficient length to reach junction boxes or power panel as shown on detailed drawings. Connection leads shall be of stranded wire. Only connection leads in conduit shall exit from heated zone.

5. Insulator shall be Magnesium Oxide only, a Fiberglass insulator is not permitted.

6. No combustible materials between heating conductor wire and ground sheath.

7. Cross section of heated portion of cable not to exceed 0.4 of an inch.

8. Tie cable to rebar or reinforcing mesh.

9. Cable rating shall be:

a. 120 VAC
b. 208 VAC
c. 240 VAC
d. 277 VAC

2.3 HEATING MATS

A. Snow Melting Mats:

1. Snow Melting Mat with alloy conductor wrapped with 4 mil Kapton® tape.

2. Conductor to be encased with .034” thick, off white silicone rubber rated at 302°F.

3. Aluminum braid shall provide ground path and mechanical strength.

4. Watt density shall be approximately 50 watts per Square Foot.

5. Cable output shall be up to 12 Watts per Linear Foot.

6. Cable shall be attached to orange high-density polyethylene mesh.

7. Mat rating shall be:

   a. 120 VAC
   b. 208 VAC
   c. 240 VAC
   d. 277 VAC

2.4 CONTROLS

A. DTC-24S, Automatic Control System:

1. Controller shall have:

   a. 3-button key pad with single level menu.
   b. LED Digital Display with manual temperature adjustment.

2. System shall have a minimum of:

   a. One 5” Diameter MP Sensor to sense moisture and slab temperature.
   b. RID remote indicator and activation timer.

3. System Activation:

   a. When slab/ambient temperature is less than the setpoint temperature and snow or moisture is present on the MP sensor.

4. System Deactivation:

   a. System will remain active for the pre-set time duration after the sensor has dried or temperature rises about the setpoint.

B. MPS, UL Listed Automatic Control System:

1. Controller shall have:

   a. Fully automated system requiring no operator settings or adjustments.
   b. Input Power Requirement of: 120VAC, 208VAC or 240VAC.

2. System shall have a minimum of:

a. One 5” Diameter MP Sensor to sense moisture and slab temperature
b. RID remote indicator and activation timer.

3. System Activation:

a. When slab/ambient temperature is less than the setpoint temperature of 40° F and snow or moisture is present on the MP sensor.

4. System Deactivation:

a. When slab/ambient temperature is greater than the setpoint temperature of 40° F or no snow or moisture is present on the MP sensor and 5 hours have elapsed.

C. Power Control Panel with G.F.P.E:

1. Controller shall have:

a. NEMA 1 rated panel enclosure with one GFPE per circuit and one green “working” LED and one red “trip” LED per circuit.
b. One red “System On” LED, one green “Control Power On” LED, and one Amber “Trip Indicator” LED on panel door.
c. Interior G.F.P.E. Test button and include Dry alarm contacts.

2. Power Control panel model shall be:

a. GFPE-2-N
b. GFPE-4-N
c. GFPE-8-N
d. GFPE-12-N

2.5 ACCESSORIES

A. Brass Embedded Heating System Marker: Fixed outdoor electric deicing marker (4” by 5” in size) shall be installed flush with surface.

1. NEC Article 426 Section 426-13, Identification, states that embedded snow-melting equipment must be evident by the posting of appropriate caution signs or markings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Installer to verify that concrete framework is ready to receive work.

B. Installer to verify field measurements are as shown on Drawings.

C. Installer to verify that required utilities are available, in proper location, and ready for use.

D. Beginning installation means installer accepts conditions.

3.2 SNOW MELTING CABLE INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Complete installation shall conform to appropriate codes and shall also be in accordance with manufacturer's specification.

C. Do not energize the system until concrete has thoroughly cured.

D. MI heating cable shall not leave heated area or cross expansion or control joints.

E. Pull stranded connector leads through conduit from condulets to junction boxes.

F. Embedded MI condulet bodies in concrete to be filled fill with water repellent powder.

G. Tie cable to rebar or reinforcing mesh.

H. Position cables 2" to 3" inches below finished surface but not less than 1.5". Install cable in accordance with detailed layout drawings.

I. Cable Spacing in Concrete: 5" to 8" inches on center per drawings.

J. Do not pinch or make sharp bends in cable.

K. Slab sensor(s) shall be placed between heating elements.

3.3 FIELD QUALITY CONTROL

A. Test continuity of heating cable.

B. Test total resistance (TR) using an ohmmeter. The ohmmeter reading should be within 10% of the calculated Total Resistance.

C. Perform Insulation resistance (IR) or "Megger" test on each heating cable before, during and after installation. Insulation resistance should be greater than 10 megohms.

D. Measure voltage and current at each unit after concrete has set-up.

E. Enter the total resistance and insulation resistance readings on the warranty card.

F. Annually check system for loose or damaged cable.

3.4 ADJUSTING AND CLEANING

A. Keep automatic control system's slab sensor(s) clean of dirt and debris.

3.5 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION 238313

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SECTION 260010 - GENERAL PROVISIONS FOR ELECTRICAL WORK

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the Contract Documents, including the General Conditions and Supplementary General Conditions and Division 1 - General Requirements apply to the work of this division.

B. General And Supplementary Conditions for Mechanical And Electrical Work, Section 01008,

C. In case of conflict between these General Provisions and the General Conditions and/or Supplementary General Conditions, the more restrictive requirements govern.

D. Drawings are diagrammatic and are a graphic representation of contract requirements to the best available standards at the scale required.

E. Light and power and system riser diagrams and schematic diagrams generally indicate equipment connections to be used for various systems. Provide system conduit and wiring as required for actual systems installed on this project. Provide all work shown on diagrams whether or not it is duplicated on the plans.

F. Specifications include incomplete sentences. Words or phrases such as "the contractor shall," "shall be," "furnish," "provide," "a," "an," "the," and "all" have been omitted for brevity.

G. Except where modified by a specific notation to the contrary, the indication and/or description of any item, in the Drawings of Specification or both, carries with it the instruction to furnish and install the item complete with all appurtenances or accessories necessary to complete any required system, regardless of whether or not this instruction is explicitly stated as part of the indication or description.

H. Specifications and Drawings are complimentary and are to be taken together for a complete interpretation of the work. Final product shall be a complete working system.

I. Drawings of necessity utilize symbols and schematic diagrams to indicate various items of work. Neither of these have any dimensional significance nor do they delineate every item required for the intended installation. Install the work in accordance with the diagrammatic intent expressed on the electrical and mechanical drawings, and in conformity with the dimensions indicated on final architectural and structural working drawings and on equipment shop drawings.

J. Certain details appear on the drawings which are specific with regard to the

dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field coordination for the indicated work.

K. Derive information as to the general construction from structural and architectural drawings and specifications.

L. Owner furnished equipment: Contractor to take ownership, accept delivery, arrange for rigging, and install per approved shop-drawings.

1. 2 DEFINITIONS

A. Where used in this document and accompanying drawings, the following words are defined as listed:

1. "Provide" to supply, install and connect up complete and ready for safe and regular operation of particular work referred to.

2. "Install" to erect, mount and connect complete with related accessories.

3. "Furnish" or "Supply" to purchase, procure, acquire and deliver complete with related accessories.

4. "Work" labor, materials, equipment, apparatus, controls, accessories and other items required for proper and complete installation.

5. "Concealed" embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces or in enclosures.

6. "Exposed" not installed underground or "concealed" as defined above.

7. "Indicated", "shown" or "noted" as indicated, shown or noted on drawings or specifications.

8. "Similar" or "equal" of base bid manufacturer, equal in materials, weight, size, design and efficiency of specified product, conforming to "Base Bid Manufacturers".

9. "Reviewed," "satisfactory," "accepted," or "directed" as reviewed, satisfactory, accepted or directed by or to Engineer.

10. "Engineer", "Owner", "Owner's Representative" the party or parties responsible for interpreting, accepting and otherwise ruling on the performance under "this Contract."

11. "This Contract", "The Contract" the agreement covering the work to be performed by "This Contractor".

12. "The Specifications", "This Section, Part, Division of the Specifications" the documents specifying the work to be performed by "This Contractor".

13. "Other", "Other Contractor", "Other Sub-Contractor", "Other Trade" persons, parties, or trades responsible for work of the project other than the parties who have been awarded the contract for this division of the work.

1.3 QUALITY ASSURANCE AND STANDARDS

A. Make the complete installation in accordance with the applicable requirements and standards of National Electrical Manufacturers Association (NEMA), National Fire Protection Association (NFPA), National Electrical Code (NEC)-2014, New York City Electrical Code Amendments to the NEC (NYCEC), Institute of Electrical and Electronic Engineers (IEEE), American National Standard Institute (ANSI), Occupational Safety and Health Administration (OSHA), National Electrical Safety Code (NESC), Insulated Cable Engineers Association (ICEA), Underwriters Laboratories (UL), Factory Mutual (FM), Factory Insurance Association (FIA), National Electrical Contractors Association (NECA) "Standard of Installation," local inspection agency, local power company, local telephone company, along with state and local municipal codes and all applicable codes and authorities having jurisdiction. Refer to the Engineer for decisions on any items or requirements noted in the Specifications or on Drawings, which conflict with the standards listed above. Provide all work necessary to comply with these requirements at no extra cost to the Owner.

B. Provide electrical equipment, materials and appliances which have the listing of Underwriters Laboratories, Inc., and bear labels attesting to UL listing and types approved by Municipal Departments having jurisdiction.

C. Where reference is made to the National Electrical Code only without mention of the New York City Electrical Code, the requirements of the latter, where they differ from the former, take precedence, where applicable. The NYC addendums to the NEC are applicable to these specifications.

1.4 ORGANIZATION OF THE WORK

A. Implement the work called for under this contract simultaneously with the work of other Trades in a manner such as not to delay the overall progress of the project. Be prepared to furnish promptly to other Trades involved at the project all information and measurements relating to the work which they may require. Cooperate with them in order to secure the harmony necessary in the interest of the project as a whole.

B. Put work in place as fast as possible to meet all construction schedules.

C. Keep a competent superintendent in charge of the work. Replace such

superintendent if unsatisfactory to the Owner.

D. Maintain a complete file of Contract and shop drawings at the Site available for inspection by Owner's Representatives. Upon installation, initial and date shop drawings.

E. Provide every facility to permit inspection or observation of the work by Owner's Representatives during the course of construction.

F. Be responsible for work until its completion and final acceptance; replace any of the same which may be damaged, lost or stolen, without additional cost to the Owner.

1.5 ACCEPTANCE OF THE WORK

A. Make all workmanship, equipment and materials supplied under this contract acceptable to the Owner and his Representatives, who have the power to reject any items which in their judgment are not in full accordance with the Drawings and Specifications.

1.6 PERMITS, CERTIFICATES, AND FEES

A. Obtain and deliver a final Certificate of Approval from the applicable inspection authority having jurisdiction. Make delivery to the Engineer for transmittal to the Owner upon completion of the work and before final payment. Pay all charges made by the inspection authority and include their cost in the bid. This applies to the Bureau of Electrical Control and the NYC Fire Department.

B. Include the procurement of and payment for all permits, certificates and fees for the performance of the electrical work in compliance with codes, applicable laws and municipal regulations including those from local utilities for services.

1.7 SCOPE OF WORK

A. The Specifications and the accompanying drawings are intended to secure the provisions of all material, labor, equipment, and services necessary to install complete, test, and ready for operation the Electrical Systems in accordance with the Specifications and Drawings. Provide all systems complete with necessary appurtenances and minor auxiliaries, including pull boxes, offsets to clear interferences, and supports which are not shown but are needed to make each system complete in every respect. Provide all work described in the Specifications and not shown on the Drawings, or vice versa, in complete working order. If mention has been omitted of any item of work or material, necessary for completion of the system, then such items must be and are hereby included. The work includes but is not limited to the following:

1. Raceways and installation components.
2. Wire and cable.
3. Safety and disconnect switches.
4. Panelboards - lighting and distribution.
5. Overcurrent protection (fuses/circuit breakers).
6. Wiring devices.
7. Distribution equipment – Panels and automatic transfer switches.
8. Installation and wiring of motor controllers furnished by others.
9. Power and control wiring to all dampers.
10. Electric service and equipment.
11. Power and control wiring systems for HVAC and sprinklers.
12. Motor control center.
13. Grounding system.
14. Lighting fixtures.
15. Furnishing and setting of all sleeves through the floors, roof and wall, where required including waterproofing and fireproof sealing and cap flashing.
16. Demolition and removal of existing unused wiring and cables.
17. Demolition and removal of service switchboards, distribution boards, automatic transfer switches, transformers, panelboards, overcurrent protective devices, safety switches, motor control centers, motor starters and all other equipment and devices called for on the drawings.
18. Testing.
19. All overtime and premium labor cost required to perform all power interruption work.
20. Modification to existing electrical distribution.
21. Cutting and patching associated with electrical work.
22. Installation and removal of temporary light and power.

23. All concrete work for pads (including housekeeping pads). Housekeeping pads to extend 4-6 inches beyond dimensions of equipment and be 4 inches high. Provide pads for all floor mounted electrical equipment, unless otherwise noted. Hardware, such as inserts, bolts, etc., associated with concrete pads.

24. Standby labor required by other trades.

25. Unit prices.

26. Prime painting, where required for electrical equipment and installation.

27. Removal of existing electrical work in accordance with the sequence of construction or as directed and required. Restoration of electrical service in affected adjoining areas which are to continue to function.

B. Continuous, Uninterrupted Electrical Power and Service

1. Make provisions to allow shut-down and switch-over of existing service and distribution equipment to new service and distribution equipment. This must be performed during overtime hours. Submit detailed written switch-over plans for review.

2. Contractor shall include in his/her bid price the cost of all overtime work required for switch-over or downtime to minimize disturbance to the operation of the Tram operation. All switch over shall be fully coordinated with a RIOC representative.

C. Existing Electrical System Survey

Contractor shall include in his/her bid price the cost of performing an existing electrical system detailed survey. Provide three copies of type-written report of the survey and a certified statement stating that the survey report is based on actual field observation and the survey report reflects the actual existing condition. The survey report shall include, but not limited to, information and location of all distribution power and lighting panels, panel feeder sizes., This survey shall determine which existing service and distribution feeder(s) will be interrupted, the length of time interruption.

1.8 EXAMINATION OF EXISTING CONDITIONS

A. Before submitting a proposal, the Contractor is responsible for visiting the site of the work, including the building, and becoming thoroughly familiar with all conditions and

limitations and comparing same with the drawings and specifications. The submission of a proposal will be construed as evidence that such an examination has been made, and later claims for labor, equipment or materials required for difficulties encountered which could have been foreseen had such an examination been made will not be recognized.

B. Verify all grades, elevations, dimensions, and clearances at the site.

C. Examine all work prepared by others to receive the work of this Division and report any defects affecting installation to the General Contractor for correction. Commencement of work will be construed as complete acceptance of preparatory work by others.

D. Existing conditions, equipment, material, and sizes are shown for reference only. Verify existing conditions and bring any discrepancies to Engineer's attention in writing prior to submission.

E. Conduct a detailed survey of existing electric power distribution system. Submit a certified report.

1.9 REMOVAL AND INSTALLATION OF NEW WORK

A. Coordinate all required removal and construction of work with RIOC representative well in advance and get in writing prior interrupting any power. Any power interruption shall be kept as minimum.

B. Remove, relocate, replace, adjust or otherwise adapt or modify existing wiring, raceways, conduit, and other electrical equipment or apparatus as required by the drawings and specifications and also as may be required when such work is uncovered or when found to interfere with the carrying out of the completion of the work of this trade or other Divisions of the work.

C. Include the furnishing of all materials, cutting, extensions, connections, repairing, adapting, and other work incidental thereto, together with such temporary connections as may be required pending completion of the permanent work.

D. Include the removal of materials, as directed, which may interfere with the installations. Replace and rearrange all such disturbed materials to suit the new conditions.

E. Leave work in good working order and in a condition equal to the adjacent new or existing work. Provide any work not shown on the drawings or mentioned in the specification but considered necessary for the completion of the work under this section without additional charge.

F. Provide openings for entry of equipment into the building and remove all obstructions that may interfere with the moving into position and the installation of the new equipment.

G. Adjust existing risers and runouts to suit the new conditions.

H. Where the present facilities are to be extended, all additional apparatus or materials furnished to match that installed in quality, finish, appearance, design and operation.

I. Where present work is damaged in the execution of this contract due to the removal of raceways, equipment or apparatus repair the same to correspond in materials, quality, shape and finish with that of similar and adjoining work, unless otherwise called for.

J. Should any damage due to the execution of this contract occur to the building finish, furniture, fixtures, or any other equipment or apparatus, properly repair such damages and make good without extra charge, with the supply of new articles or otherwise, as may be required, to leave the building and plant in perfect order at completion.

K. Present material or equipment may be reused only when same is specified or shown on the drawings to be reused or relocated. Provide all other materials and equipment new and as specified.

L. The work of taking down and removing any part of present equipment, of making alterations or of preparing for and replacing new work therein to be done only after permission has been obtained from the Engineer.

M. Plan installation of new work and connection to existing work to insure minimum interference with regular operation of Tram. Work to be done in accordance with the schedule agreed upon mutually between Owner and the Contractor.

N. Disconnect, remove and/or relocate electrical material, equipment, devices, components, and other work noted and required by demolition or alterations.

O. Provide new material and equipment required for relocated equipment.

P. Cut and cap abandoned floor raceways flush with concrete floor or behind walls and ceilings.

R. Dispose of removed electrical equipment as directed.

T. Connect new work to existing work in a neat and acceptable manner, with minimum interference to existing facilities.

U. Maintain continuous operation of existing facilities affected by the work.

V. Interrupt alarm and emergency systems only with the written consent of the RIOC representative.

1.10 SHOP DRAWINGS AND OTHER INFORMATION REQUIRED

A. Submit a shop drawing submittal schedule delineating the sequencing of shop drawings and dates of submittal prior to submittal of shop drawings. Make submittals in accordance with schedule so as to cause no delay in the work or in the work of any other contractor.

B. Prior to purchasing equipment or materials, submit a list of proposed manufacturers.

C. Shop drawings which are submitted out of sequence or without supplemental information necessary for proper evaluation of the submission are subject to delays in processing.

D. Shop drawings must bear the Prime Contractor's stamp certifying:

1. That he has checked the submitted subcontractor's shop drawings.

2. That the submitted shop drawing is fully coordinated with all interfacing trades and with other trades where interference may occur.

3. That the submitted shop drawings are in conformance with the contract documents.

E. Prior to assembling or installing the work, submit the following for review:

1. Catalog information and factory assembly drawings, as required for a complete explanation and description of all fixtures, devices and items of equipment.

2. Field installation drawings, as required to explain fully all procedures involved in erecting, mounting and connecting all items of equipment.

3. Drawings indicating main conduit runs, risers, panelboards, switchboards, signal and miscellaneous cabinets, pull, splice and junction boxes.

F. Scale Composite Drawings: Provide layout of electrical work, including but not

limited to, lighting fixtures, main conduit runs, panelboards, distribution equipment, pullboxes, etc., in electrical and mechanical equipment room to the sheet metal subcontractor for inclusion on a scaled composite drawing. Composite drawing to include raceway sizes and elevation of all work. This contractor is required to sign off in the composite drawing attesting to the full coordination of the electrical work with all trades.

G. Submit samples of the following items to the Engineer for acceptance:

1. Lighting switches and receptacles
2. Switch and receptacles plates
3. Outlet boxes (if requested)
4. Lighting fixtures (if requested)
5. Wire and cable (if requested)
6. Conduit and conduit fittings (if requested)
7. Additional items as requested by Engineer

H. Materials installed or work performed without acceptance of materials is done at the risk of the Contractor, and the cost of removal of such material or work which is judged unsatisfactory for any reason is at the expense of the Contractor.

I. Documents will not be accepted for review unless:

1. Number of copies and type of paper complies with the requirements of the general conditions.
2. Complete information pertaining to appurtenances and accessories is included.
3. Submitted as a package where documents pertain to related items.
4. Properly marked with service or function identification as related to the project, where they consist of catalog sheets displaying other items which are not applicable.
5. Properly marked with external connection identification as related to the project where they consist of standard factory assembly or field installation drawings.

J. Shop drawings and other submissions which are submitted for review will be returned with a Shop Drawing stamp indicating actions based on reviews that are made and Contractor's responses that may be necessary. Actions noted regarding

"REVIEW" and "RESPONSE" portions of the shop drawing stamp are defined as follows:

1. Review Portion

   a. Incomplete: Item submitted without Contractor's stamp as stated above.
   b. No Exceptions Taken: Contractor may install the items submitted in conformance with the plans and specifications.
   c. Rejected: Item submitted fails to meet criteria in specifications and/or drawings.
   d. Comments Attached: Additional sheet has been attached to the shop drawing submittal and is being returned to the Contractor; additional sheets may include comments which could not be made on the submittal due to limited space or may request additional information.
   e. Note Marking: Notations made directly on the shop drawing submittal.

2. Response Required by Contractor Portion

   a. Confirm: Contractor to confirm that he will comply with comments made under items 1d or 1e above; if the Contractor agrees with the comments, proceed with the fabrication and installation.
   b. Resubmit: Contractor to resubmit shop drawings for review based upon paragraphs 1a and 1c and may also be required to resubmit under paragraphs 1d and 1e.

1.11 RECORD DRAWING

A. Before commencing work, procure complete set of black and white prints of Contract Drawings.

B. Maintain prints in field office and permanently record, in colored pencil, on such prints, at time of occurrence, deviations from Contract Drawings, due to:

   1. Field Coordination

   2. Addenda

   3. Bulletins

C. Dimension underground utilities from permanent identifiable structural points.

D. Make drawings available for Engineer's periodic inspection and submit for review with As-Built Drawings.

1.12 AS-BUILT DRAWINGS

A. Before commencing work, procure complete set of Contract Drawings on or AutoCAD format.

B. Neatly revise to conform to Record Drawings.

C. Conspicuously indicate major deviations in Mechanical and Electrical Equipment Rooms by specific reference to shop drawings of these rooms and provide an accurate and complete record of the work as installed.

D. Submit up-to-date "in progress" prints to Engineer when requesting payment for work installed.

E. Upon completion of work, submit signed and certified as As-Built and referenced Shop Drawings, along with marked up prints of Record Drawings, to Engineer for acceptance.

1.13 COORDINATION OF WORK WITH OTHER TRADES

A. Coordinate the work of this division with the work of all other Contracts, the Utility Company, and the Telephone Company, and so arrange that there will be no delay in the proper installation and completion of any part or parts of each respective work wherein it may be interrelated with that of this Contract so that generally all construction work can proceed without delaying the completion of the project. Forward all communications of a coordinating nature to the Engineer via the General Contractor.

B. Examine contract drawings and specifications for all other trades (HVAC, Sprinklers, etc.) relating to this project, verify all governing conditions at the site, and become fully informed as to the extent and character of the work required and its relation to other work in the building. No consideration will be granted for any alleged misunderstanding of the materials to be furnished for work to be done.

C. Scaled and figured dimensions with respect to the items are approximate only; sizes of equipment have been taken from typical equipment items of the class indicated. Before proceeding with work, carefully check all dimensions and sizes and assume full responsibility for the fitting-in of equipment and materials to the building and to meet architectural and structural conditions.

D. Coordinate work with other disciplines. Confer with other contractors whose work might affect this installation; and arrange all parts of this work and equipment in proper relation to the work and equipment of others, with the building construction and with architectural finish so that this work will harmonize in service, appearance, and function.

E. Install exposed conduit or other types of raceway to provide the maximum amount of

headroom but in no case install the raceway less than 7 feet above the finished floor. Install conduit concealed in areas where hung ceilings or other furred spaces are indicated.

F. Refer to the Architectural and/or Interior Designer's Drawings for ceiling heights, locations and types of hung ceilings and furred spaces.

G. Furnish to the Contractors for General Construction, detailed advance information regarding all requirements related to work under other Divisions and/or Sections. Furnish sizes, accurate data, and locations of any and all pads, pits, chases, sleeves, and slots through floor slabs, walls, foundations, ceilings, roof, and other special openings required for work under this Division.

H. In a timely fashion obtain sepia drawings for trade coordination (provided by HVAC Contractor), indicate work and coordinate accordingly. Attend coordination meetings held in location and at frequencies in accordance with the directions of the General Contractor. When coordination is complete to the satisfaction of the General Contractor, sign-off" the coordination drawings.

I. Prior to submit price, coordinate with General Contractor or Engineer for all material and labor required to support work performed by other trades, which include, but not limited to, temporary power, stand-by labor, hoisting, etc.

1.14 PROTECTION, MAINTENANCE AND PRODUCT HANDLING OF ELECTRICAL EQUIPMENT

A. Deliver and store electrical equipment at the site, properly packed and crated until finally installed. Store materials in spaces as designated by the General Contractor. Investigate each space through which equipment must be moved. If necessary, have equipment shipped from manufacturer in crated sections of size suitable for moving through restricted spaces.

B. Adequately protect uninstalled and installed equipment and materials against loss or stealing, damage caused by water, paint, fire, plaster, moisture, acids, fumes, dust or other environmental conditions, or physical damage, during delivery, storage, installation and shutdown conditions. Replace any damaged or stolen material without extra cost to the Owner.

C. Provide effective protection for all material and equipment against damage that may be caused by environmental conditions. Do no work when conditions of temperature in area or moisture on materials or substrates are not in accordance with material manufacturer's recommended conditions for installation.

D. Maintain all equipment and systems installed, until final acceptance by the Engineer and the Owner. The operation of the equipment by the Owner or his authorized representative does not constitute an acceptance of the work. Work will be accepted only after the Contractor has adjusted his equipment, demonstrated that it fulfills the requirements of the Drawings and Specifications, and has furnished all

required certificates.

E. Provide effective protection against damage for all materials and equipment during shipment, and storage at the Project Site. Cover all stored equipment to exclude dust and moisture. Place stored conduit on dunnage with appropriate weather cover and caps on exposed ends.

F. After cabinets and boxes are installed, cover openings to prevent entrance of water and foreign materials. Close conduit openings with temporary metal or plastic caps, including those terminated in cabinets.

G. Protect all rough and finished floors and other finished surfaces from damage which may be caused by construction materials and methods. Protect floors with tarpaulins, drip pans and oil-proof floor covering. Protect finished surfaces from welding and cutting splatters with baffles and splatter blankets. Protect finished surfaces from paint droppings, adhesive and other marring agents with drop cloths. Protect other surfaces with appropriate protective measures.

H. Deliver materials to Project Site in manufacturer's original unopened containers with manufacturer's name and product identification clearly marked thereon.

I. After completion of project, clean the exterior surfaces of equipment furnished in this Division including concrete residue.

1.15 EQUIPMENT AND MATERIALS

A. Provide Equipment and Materials required for installation under the Specifications new and without blemish or defect. Provide equipment and materials which will meet with the acceptance of authorities having jurisdiction over the work. Where such acceptance is contingent upon having the products listed or labeled by Underwriters Laboratories Inc., or other test laboratory, provide products so listed or labeled. Where no specific indication as to the type or quality of material or equipment is indicated, furnish a first class standard article.

B. Wherever a manufacturer of a product is specified and the terms "other approved" or "approved equal" or "equal" or "similar to" are used, the substituted item must conform in all respects to the specified item. Consideration will not be given to claims that the substituted item meets the performance requirements with lesser construction. Performance as delineated in schedules and in the Specifications indicate minimum performance. In many cases, equipment is oversized to allow for pick-up loads, derating and future loads which cannot be delineated under the minimum performance.

C. Provide all equipment of one type (such as switchboards, panelboards, etc.) produced by one manufacturer.

D. Substituted equipment where permitted and accepted must conform to space requirements. Replace at Contractor's expense any substituted equipment that

cannot meet space requirements, whether accepted or not. Make any modifications of related systems as a result of substitutions at Contractor's expense.

E. Note that shop drawings, or other information submitted in accordance with the requirements hereinbefore specified, do not assure that the Engineer, or any other Owner's Representative, attests to the dimensional suitability of the material or equipment involved. Engineer's failure to object to shop drawings does not invalidate the Drawings and Specifications if in conflict; unless a letter requesting such change is submitted and accepted on the Engineer's letterhead.

F. Substitutions of equipment for that listed on the schedules or designated by model number in the Specifications will not be considered if the item listed or described is not a regular cataloged item shown in the current catalog of the manufacturer and been successfully used for a period of not less than five years.

1.16 ACCESS DOORS IN FINISHED CONSTRUCTION

A. Access doors as required for operation and maintenance of concealed equipment, valves, controls, pull boxes, etc., shall be provided by the Prime Contractor under another section of the specification.

B. Coordinate and prepare a location, size, and function schedule of access doors required and deliver to a representative of the installing Trade and the Engineer for acceptance.

1.17 EQUIPMENT MOUNTING HEIGHTS

A. Refer to Design Drawings, sections, wall elevations, details, schedules, etc., for all specific mounting heights of fixtures, wall mounted outlets, switches, equipment, etc. Where no mounting data is specifically noted, then mount equipment in accordance with the following unless otherwise noted. (Dimensions are above finished floor unless noted.)

1. Receptacle outlets in walls, partitions or columns: 18 inches to centerline, unless otherwise noted.

2. Receptacles or telephone outlet in mechanical spaces, electric switchboard rooms, electrical rooms: 4'-0" to centerline.

3. Toggle switch outlet in walls, partitions or columns: 4’-0” to centerline.

4. Individual distribution system switching device (with or without overcurrent protection): 5'-0" to centerline.

5. Group mounted distribution system switching devices: 6'-0" maximum to centerline of highest switching device handle.

6. Wall exit sign: As per Engineer. When sign is over doors, coordinate with top of door frame and ceiling height. When space permits, mount bottom of sign 2" clear of door frame.

7. Outlet for any signal system sounding device as required for device to clear underside of ceiling by 1" minimum.

8. No devices, outlets switches, etc., shall be permitted to be mounted half on one type wall surface and half in another. Mount devices, etc., entirely on same surface.

B. Field instructions issued by the Engineer take precedence over the above list.

C. Mounting heights of pendent mounted lighting fixtures as directed in the field by the Engineer.

1.18 SEPARATION OF WORK BETWEEN THE TRADES

A. The specifications describe in detail the work included for each trade. The following summary is an outline of the work to be "Provided," "Furnished" or "Installed" by each of the trades included in the contract, i.e., Prime Contractor, Plumbing, Sprinkler, HVAC, and Electrical.

B. In the absence of more detailed information, consider the list as specific instructions to include such work in the named contract.

C. Abbreviations are as follows:

1. "Oth" - Prime
2. "Plb" - Plumbing
3. "Spr" - Sprinkler
4. "Htg" - Heating, Ventilating and Air Conditioning
5. "Elec" - Electrical
6. "f" - Furnished
7. "i" - Installed
8. "p" - Provided (Furnished and Installed)
9. BMS Building management System

ITEM	Oth	Plb	Spr	Htg	Elec	BMS	Remarks
Motors for HVAC, Plumbing, Fire Protection Equipment	_	p	p	p	_	_	
Motor Controls							

for HVAC, Plumbing, Fire Protection Equipment	_	f	f	f	i	_	Specifications and drawings delineate detailed exceptions.
ITEM	Oth	Plb	Spr	Htg	Elec	BMS	Remarks
Wiring for HVAC, Plumbing, Fire Protection Equipment Motors	_	_	_	_	p	p	Specifications and drawings delineate detailed exceptions.
Wiring for Mechanical							Specifications and drawings delineate
ITEM	Oth	Plb	Spr	Htg	Elec	BMS	Remarks
Equipment Motor Controls and Alarms	_	_	_	_	p	_	in detail the work to be performed by each trade.
Temporary Light and Power	_	_	_	_	p	_	
Temporary Fire Protection	_	_	p	_	_	_	
Hoisting	p	p	p	p	p	p	
Rigging	p	p	p	p	p	p	
Bracing of Building for Safe Rigging	p	_	_	_	_	_	
Cutting, Chasing & Patching	p	_	_	_	_	_	Cost where due to late installation or improper coordination of work is the responsibility of the delinquent trade.
Framed Slots and Openings in Walls, Decks and Slabs	p	_	_	_	_	_	Includes drilling of holes when required.
Sleeves	_	p	p	p	p	p	

ITEM	Oth	Plb	Spr	Htg	Elec	BMS	Remarks
Waterproof Sealing of Sleeves through Waterproof Slabs, Decks and Walls	_	p	p	p	p	p	
Fireproof Sealing of Excess Openings in Slabs, Decks and Fire Rated Walls	_	p	p	p	p	p	
Fastenings	_	p	p	p	p	p	
Supports	p	p	p	p	p	p	
Concrete Encasement of Conduits	_	_	_	_	p	_	
Finish Painting	p	_	_	_	_	_	Red painting of exposed wire protection alarm system circuitry included in electrical.
Finished Walls and Ceiling access Access Doors, Panels and Supporting Frames	i	f	f	f	f	f	Supplying list of location of all items requiring doors included in the Division requiring same.
Plaster Rings and Frames	i	_	_	_	f	_	Plaster rings and frame furnished in electric only for fixtures which are so equipped.
Rubbish Removal	p	p	p	p	p	p	Where one trade furnishes and another

							installs, the installing trade removes the shipping and packing materials which accumulate.
Special Tools for Equipment Maintenance	f	f	f	f	f	f	
Electric Heaters with Integral Fans included	_	_	_	p	_	_	Line and Control Connections and Control devices mounting in electric.
ITEM	Oth	Plb	Spr	Htg	Elec	BMS	Remarks
Concrete Foundations, Pads, Pits, Curbs, and Bases Inside Buildings	p	_	_	_	p	_	Furnishing exact dimensions of anchors, vibration mounts and templates included in each trade providing the associated equipment.
Concrete Foundations Pads and Bases included in Outside Buildings	p	_	_	_	_	_	Furnishing exact dimensions of anchors, vibration mounts and templates included in each trade providing the associated equipment.
Prime Coat Painting	_	p	p	p	p	p	
Field Touch-up Painting of Damaged Shop Coats	_	p	p	p	p	p	
Rustproofing Field Cut and Assembled Iron Supporting Frames and Racks	_	p	p	p	p	p	

Grating and Exterior Wall Louvers	p	_	_	_	_	_	
Duct Connections to Louvers	_	_	_	p	_	_	
Roof Curb Cap Flashing	_	p	_	p	_	_	
Roof Curb Base Flashing	p	_	_	_	_	_	
Vermiculite							
ITEM	Oth	Plb	Spr	Htg	Elec	BMS	Remarks
Fireproof Duct Covering	p	_	_	_	_	_	
Equipment Delivered and Set in Place	p	_	_	_	_	_	Except Mechanical and Electrical Equipment by Divisions 22, 23, 26.
Vinyl Tape or Painted Color-Coding, Banding, Arrows and Similar Identi-fication for Mechanical and Electrical Work	p	p	p	p	p	p	
.							
Lighting Fixtures	_	_	_	_	p	_	See Drawings.
ITEM	Oth	Plb	Spr	Htg	Elec	BMS	Remarks
Catwalks and Ladders to Mechanical Equipment	p	_	_	_	_	_	
Roughing to Equipment Furnished by							

Others _ p p p p _

D. Each Division is required to supply all necessary supervision and coordination information to any other Division supplying work to accommodate that Division.

E. For items which are to be installed but not purchased as part of this Division, the electrical work includes:

1. Coordination of their delivery.

2. Unloading from delivery trucks driven into any point on the property line at grade level.

3. Safe handling and field storage up to the time of permanent placement in the project.

4. Correction of any damage, defacement or corrosion to which they may have been subjected.

5. Field make-up and internal wiring as indicated for their proper operation.

6. Transporting from storage to final installation location. Mounting in place.

7. Connection to building wiring, including the purchase and installation of all termination junction boxes necessary to adapt and connect them to this wiring.

1.19 LIMITING NOISE PRODUCED BY ELECTRICAL INSTALLATIONS

A. Make all electrical equipment and work operate under all conditions of load without sound or vibration that is objectionable, in opinion of the Engineer and Owner. Correct sound or vibration conditions considered objectionable in approved manner by electrical contractor at his expense.

1.20 TEMPORARY LIGHT AND POWER

A. Utilize existing electric service for all temporary light and power.

B. Energy cost for temporary light and power shall be borne by Owner.

C. Utilize existing lighting system for temporary lighting.

D. Provide all wiring, supports, lamp sockets, receptacle sockets and any other materials, supplies or equipment necessary for temporary light and power system to area where existing lighting system and receptacles are not in operation or inadequate.

E. Provide branch circuit panels containing ground fault protection branch circuit breakers where ground fault protection is required by OSHA for temporary receptacle circuits to area where existing electric system is not in operation.

F. Where required install separate stringer circuits for lighting and receptacles and provide one lamp socket and one duplex receptacle (or two single receptacles) for every 400 square feet of new general construction area (approximately 20 feet on centers). Replace burned out lamps as required for as long as the temporary lighting system is maintained in operation.

G. Provide sufficient supplementary temporary lighting to permit proper execution of the work, including but not limited to the following:

1. Construction hoist landings.

2. Stairways and stairway landings where existing illumination is inadequate due to alterations or construction.

3. Interior rooms not covered with general construction area lighting.

H. Provide power wiring as required to support all construction trades, such as hoist, welding machines, unit heaters, etc. Provide fused disconnect switch at each location with fuse size, wiring size and disconnect as required. Coordinate with all trades prior to submit price.

1.21 TESTS AND ACCEPTANCE

A. Before application for final acceptance of the work will be considered, perform and complete all tests deemed necessary to show proper execution of the work in the presence of the Engineer and/or other parties who may have legal jurisdiction. Arrange scheduling of all testing procedures to suit the convenience of the Engineer. As a minimum, provide all testing in accordance with National (International) Electrical Testing Association Acceptance Testing Specification for Electrical Power Distribution Equipment and Systems.

B. Include the provision of any assistance (such as removal of panelboard trims and junction and pull box covers) deemed necessary by the Engineer to demonstrate compliance with the requirements of the Drawings and Specifications.

C. Where equipment, supplied separate from the electric work, is energized, controlled or otherwise made operative by electric work wiring systems, the Trade responsible for the equipment is responsible for conducting the testing and making available any electrical testing equipment necessary to provide the proper functional performance of such wiring system. The electrical work however, includes cooperation in such testing and providing personnel on an "as need basis" for any necessary electrical testing equipment.

D. Insure that all components of the Systems, wired by this Trade including the controls, are operating satisfactorily before any of the work will be considered complete.

E. Test installation for ground and short circuits. If test indicates inadequate insulation resistance, make corrections as directed by the Engineer.

F. Provide all instruments, labor or other facilities required for such tests.

G. Correct any defects or deficiencies discovered in any of the electrical work.

H. The duration of tests, as a minimum, will be as determined by all authorities having jurisdiction, but in no case less than the time prescribed.

1.22 OPERATING AND MAINTENANCE INSTRUCTIONS

A. After completion of all required equipment and system tests and unless specifically noted elsewhere in these specifications, provide at Owner's/Operator's convenience knowledgeable personnel and necessary equipment to reasonably instruct and demonstrate the operation and maintenance of said equipment and system. Arrange for the related manufacturer or authorized representative to assist with this orientation.

B. After completion of all required equipment and system tests and unless specifically noted elsewhere in these specifications, provide at owner's/operator's convenience, knowledgeable personnel and necessary equipment to reasonably instruct and demonstrate the operation and maintenance of said equipment and system. Arrange for the related manufacturer or authorized representative to assist with this orientation.

C. Before requesting acceptance of work, furnish 5 copies of a complete instruction manual, typewritten or printed bound.

D. Include the following in the instruction manuals:

1. Table of Contents

2. Introduction - Explanation of manual and its use

3. Description of system or equipment

   a. Complete schematic drawings of all systems
   b. Functional and sequential description of all systems.

4. Systems operation

   a. Operation procedures

b. All posted instruction charts

5. Maintenance

a. Systems trouble-shooting charts
b. Procedures for checking out functions
c. Recommended list of spare parts

6. Listing of manufacturers

7. Manufacturer's data: Where multiple model, type and size listings are included, clearly and conspicuously indicate those that are pertinent to this installation.

a. Description - literature, drawings, illustrations, certified performance charts, technical data, etc.
b. Operation
c. Maintenance - including complete trouble-shooting charts
d. Parts list
e. Names, addresses and telephone numbers of recommended repair and service companies
f. Guarantee data

1.23 GUARANTEES AND CERTIFICATIONS

A. Guarantee all work to be free from leaks or defects. Replace or repair, as directed by Engineer, defective materials or workmanship, as well as damage to the work of the Trades resulting from same for the duration of stipulated guarantee periods.

B. The duration of guarantee periods following the date of acceptance of the entire work is as follows:

1. For work not otherwise specified, one year.

2. For heating systems, one year plus any time necessary to include one continuous heating season, from November 1 to April 1.

3. For air conditioning systems, one year plus any time necessary to include one continuous cooling season from May 1 to October 1.

C. Submit certification attesting to the fact that specified performance and other criteria are met by all items of equipment.

1.24 SITE VISITS FOR OBSERVATION

A. As the project progresses, the Engineer, at their discretion, will perform site visits to

observe the mechanical and electrical installations. At the conclusion of these site visits, punch lists will be issued to the appropriate Contractor for the deficiencies in the work of his trade. Complete all work and perform all corrective measures as required by the punch lists. After this corrective and completion work has been accomplished advise the Engineer in writing that every item on the punch lists has been completed.

END OF SECTION 260010

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SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.

2. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements: (NA)

DEFINITIONS

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member Company of NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. **Copper** Conductors: Comply with NEMA WC 70/ICEA S-95-658.

B. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for **Type THW-2**.

C. VFC Cable:

1. Comply with UL 1277, UL 1685, and NFPA 70 for Type TC-ER cable.

2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: **Copper** Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for **No. 10** AWG and smaller; stranded for **No. 8** AWG.

3.2 CONDUCTOR INSULATION CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: **Type THHN/THWN-2, single conductors in raceway Type SE**

B. Exposed Feeders: **Type THHN/THWN-2, single conductors in raceway**.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: **Type THHN/THWN-2, single conductors in raceway**

D. Feeders in Cable Tray: **Type THHN/THWN-2, single conductors in raceway**.

E. Exposed Branch Circuits, Including in Crawlspaces: **Type THHN/THWN-2, single conductors in raceway**

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: **Type THHN/THWN-2, single conductors in raceway**

G. Branch Circuits in Cable Tray: **Type THHN/THWN-2, single conductors in raceway**

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means; including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

G. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material **and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors**.

C. Wiring at Outlets: Install conductor at each outlet, with at least **12 inches (300 mm)** of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspection **with the assistance of a factory-authorized service representative**:

1. After installing conductors and cables and before electrical circuitry has been energized, test **service entrance and feeder conductors and conductors feeding the following critical equipment and services** for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

   a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
   b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
   c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

D. Test and Inspection Reports: Prepare a written report to record the following:

1. Procedures used.

2. Results that comply with requirements.

3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519

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SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes all grounding and bonding systems and equipment per code.

1.3 ACTION SUBMITTALS

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

B. Qualification Data: For testing agency and testing agencies field supervisor.

C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Instructions for periodic testing and inspection of grounding features at **grounding connections for separately derived systems at service and Water main location,** based on **NFPA 70.**

1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
2) Include recommended testing intervals.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

B. 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.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 CONDUCTORS

A. Insulated Conductors: **Copper** wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.

2. Stranded Conductors: ASTM B 8.

3. Tinned Conductors: ASTM B 33.

4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.

5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick..

C. Grounding Bus: Predrilled rectangular bars of annealed copper, **1/4 by 4 inches (6.3 by 100 mm)** in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V.

2.3 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless **compression** type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.4 GROUNDING ELECTRODES

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor No. 8 AWG and smaller, and stranded conductors for **No. 6** AWG and larger unless otherwise indicated.

B. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.

2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

2. Connections to Ground Rods at Test Wells: Bolted connectors.

3. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Establish a service grounding system for the entire electrical distribution system. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Generator: confirm the installation of grounding electrode(s) at the generator locations. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.4 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.

2. Lighting circuits.

3. Receptacle circuits.

4. Single-phase motor and appliance branch circuits.

5. Three-phase motor and appliance branch circuits.

6. Flexible raceway runs.

7. Armored and metal-clad cable runs.

8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

9. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

3.5 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

C. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

D. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

3. Test completed grounding system at each location where a maximum ground-resistance level is specified; at service disconnect enclosure grounding terminal Make tests at main ground before any conductors are connected.

   a. Perform tests by fall-of-potential method according to IEEE 81.

D. Grounding system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

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SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.

2. Construction requirements for concrete bases.

B. Related Sections include the following:

C. EMT: Electrical metallic tubing.

D. IMC: Intermediate metal conduit.

E. RMC: Rigid metal conduit.

F. Pull Boxes and Splice boxes.

G. Panels, Switches and every electrical device requiring hanging and/or support.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of **five** (5) times the applied force.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.

2. Nonmetallic slotted support systems.

B. Shop Drawings: **Signed and sealed by a qualified professional engineer.** Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.

2. Steel slotted channel systems. Include Product Data for components.

3. Nonmetallic slotted channel systems. Include Product Data for components.

4. Equipment supports.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. B-line, an Eaton business.
b. Thomas & Betts Corporation; A Member of the ABB Group.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

4. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: **Steel** hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical-Expansion Anchors: Insert-wedge-type,[**zinc-coated** steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

5. Toggle Bolts: All-steel springhead type.

6. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and EMT as **required by NECA 1, where its Table 1 lists maximum spacing less than stated in**] NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted **or other** support system, sized so capacity can be increased by at least (**25%**) **twenty five** percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with **two-bolt conduit clamps**.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, **EMT**, **IMC**, **RMC** may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.

2. To New Concrete: Bolt to concrete inserts.

3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.

4. To Existing Concrete: Expansion anchor fasteners.

5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.

6. To Steel: **Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts**.

7. To Light Steel: Sheet metal screws.

8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate **by means that meet seismic-restraint strength and anchorage requirements**.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use **3000-psi (20.7-MPa)** 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in **Section 033000 "Cast-in-Place Concrete." Section 033053 "Miscellaneous Cast-in-Place Concrete."**

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2. Install anchor bolts to elevations required for proper attachment to supported equipment.

3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

END OF SECTION 260529

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SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Metal wireways and auxiliary gutters.
3. Surface raceways.
4. Boxes, enclosures, and cabinets.

1.3 DEFINITIONS

A. GRC: Galvanized rigid steel conduit. (Underground in trenches)

B. EMT: Electric Metallic Tubing

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways, pull boxes, splice boxes and fittings, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and boxes. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.

2. HVAC, Plumbing items and architectural features in paths of conduit groups with common supports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. GRC: Comply with ANSI C80.1 and UL 6.

C. IMC: Comply with ANSI C80.6 and UL 1242.

D. EMT: Comply with ANSI C80.3 and UL 797.

E. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.

2. Fittings for EMT:

a. Material: **die cast**.
b. Type: Setscrew

3. Expansion Fittings: Install to match conduit type, complying with UL 651, rated for environmental conditions wherever installed, and including flexible external bonding jumper.

F. Joint Compound for IMC, GRC, or Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, **Type 1** unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Wireways Covers: **Hinged type** unless otherwise indicated.

D. Finish: Manufacturer's standard enamel finish.

2.3 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with Snap-On covers complying with UL 5. **Manufacturer's standard enamel finish.**

1. Material: **Electric Metal Tubing with ivory baked-enamel finish**.

2.4 BOXES, ENCLOSURES

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in locations where shown.

B. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

C. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

D. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, **Type 1**with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out.

E. Cabinets:

1. NEMA 250, **Type 1** galvanized-steel box and removable front, finished inside and out with standard enamel.

2. Hinged door in front cover with flush latch and concealed hinge.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: **EMT**. Unless otherwise noted.

2. Buried in underground trench where shown on drawings and Subject to Severe Physical Damage: **GRC**.

3. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250

4. Rigid steel for exterior conduits.

B. Minimum Raceway Size: **3/4-inch (21-mm)**] trade size.

C. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.

2. EMT: Use **setscrew steel cast-metal** fittings. Comply with NEMA FB 2.10.

3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

D. Install surface raceways only where indicated on Drawings.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run. Support within 12 inches (300 mm) of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches (300 mm)of enclosures to which attached.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

K. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

L. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

M. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

N. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

O. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

P. Surface Raceways:

1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.

2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

Q. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

R. Underground: Install GRC raceways in underground trenches.

S. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC **and EMT** conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).

T. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

U. Mount boxes at heights indicated on Drawings.

V. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

W. Support boxes by spanning two framing members or mounting on brackets specifically designed for the purpose.

X. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

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SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.

2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.

2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Sealing Elements: **EPDM** rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2. Pressure Plates: **Carbon steel**

3. Connecting Bolts and Nuts: **Carbon steel, with corrosion-resistant coating,** of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, assembly made for embedding in concrete slab or wall..

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

2. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."

b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

3. Size pipe sleeves to provide **1/4-inch (6.4-mm)** annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.

4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

5. Install sleeves for floor penetrations. Extend sleeves installed in floors **2 inches (50 mm)** above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.

2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

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SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 [**and IEEE C2**].

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. **Black letters on an orange field**

2. Legend: Indicate voltage **and system or service type**.

C. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.

2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING."

D. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

E. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretension, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretension, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

G. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

2.2 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Self-Adhesive, Self-Laminating Polyester Labels: **Preprinted** 3-mil- (0.08-mm-) thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of conductor it identifies and to stay in place by gripping action.

D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve with diameter sized to suit diameter of conductor it identifies and to stay in place by gripping action.

E. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around conductor it identifies. Full shrink recovery at a maximum of 200 deg F (93 deg C). Comply with UL 224.

F. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.3 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.

2. 1/4-inch (6.4-mm) grommets in corners for mounting.

3. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.

2. 1/4-inch (6.4-mm) grommets in corners for mounting.

3. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

3. Example of wording "…..**e.g., arc-flash, multiple services and voltages….", and others**.

2.4 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with **black letters on white face**

2. Punched or drilled for mechanical fasteners.

3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.5 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

E. Stenciled Legend: In nonfading, waterproof, **black** ink or paint. Minimum letter height shall be **1 inch (25 mm)**

2.6 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).

2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).

3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).

4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).

2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).

3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).

4. Color: Black.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, self-locking.

1. Minimum Width: 3/16 inch (5 mm).

2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 7000 psi (48.2 MPa).

3. UL 94 Flame Rating: 94V-0.

4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).

5. Color: Black.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.

G. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

I. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. In Spaces Handling Environmental Air: Plenum rated.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.

2. Power.

3. UPS.

B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase **and Voltage Level** Identification, 600 V or Less: Use colors listed below for ungrounded **service feeder and branch-circuit** conductors.

a. Color shall be factory applied or **field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit**.

b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

C. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

D. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, and handholes, use **self-adhesive vinyl labels** with the conductor or cable designation, origin, and destination.

E. Conductors to Be Extended in the Future: Attach **write-on tags** to conductors and list source.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: **Baked-enamel warning signs**.

1. Comply with 29 CFR 1910.145.

2. Identify system voltage with black letters on an orange background.

3. Apply to exterior of door, cover, or other access.

4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches.
b. Controls with external control power connections.

H. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

I. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for **power transfer**.

J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: **Engraved, laminated acrylic or melamine label**. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
c. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be **engraved**, laminated acrylic or melamine label.
b. Enclosures and electrical cabinets.
c. Access doors and panels for concealed electrical items.
d. Switchgear.
e. Switchboards.
f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
g. Substations.
h. Emergency system boxes and enclosures.
i. Motor-control centers.
j. Enclosed switches.
k. Enclosed circuit breakers.
l. Enclosed controllers.
m. Power transfer equipment.

n. Monitoring and control equipment.

END OF SECTION 260553

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SECTION 262416 - PANELBOARDS

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. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. ATS: Acceptance testing specification.

B. GFCI: Ground-fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. MCCB: Molded-case circuit breaker.

E. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

1. Include materials, switching and overcurrent protective devices.

2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.

2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.

3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.

4. Detail bus configuration, current, and voltage ratings.

5. Short-circuit current rating of panelboards and overcurrent protective devices.

6. Include evidence of NRTL listing for series rating of installed devices.

7. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Panelboard Schedules: For installation in panelboards. **Submit final versions after load balancing.**

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: **Two (2)** spares for each type of panelboard cabinet lock.

2. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

3. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Handle and prepare panelboards for installation according to **NEMA PB 1**.

1.10 FIELD CONDITIONS

A. Environmental Limitations:

1. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding **23 deg F (minus 5 deg C)** to plus 104 deg F (plus 40 deg C).

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Engineer and **Owner** no fewer than **two (2)** days in advance of proposed interruption of electric service.

2. Do not proceed with interruption of electric service without **Owner's** written permission.

3. Comply with NFPA 70E.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: (**18**) **eighteen** months from date of Substantial Completion.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metering that fails in materials or workmanship within specified warranty period.

1. Metering Warranty Period: **Five (5)** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 Siemens

A. Square D

B. Schneider

C. GE

D. Emerson

2.2 PANELBOARDS COMMON REQUIREMENTS

A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

B. 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.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

E. Enclosures: **Surface**-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, **Type 1**

2. Height: 84 inches (2.13 m) maximum.

3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.

4. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.

5. Finishes:

   a. Panels and Trim: **Steel and galvanized steel**, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
   b. Back Boxes: **Galvanized steel Same finish as panels and trim**.

F. Incoming Mains:

1. Location: **Top**

2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

G. Phase, Neutral, and Ground Buses:

1. Material: **Hard-drawn copper, 98 percent conductivity**.

   a. Bus shall be fully rated the entire length.

2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.

3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

4. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.

5. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.

6. Split Bus: Vertical buses divided into individual vertical sections.

H. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: **Hard-drawn copper, 98 percent conductivity**.

2. Terminations shall allow use of 75 deg C rated conductors without derating.

3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.

4. Main and Neutral Lugs: **Mechanical** type, with a lug on the neutral bar for each pole in the panelboard.

5. Ground Lugs and Bus-Configured Terminators: [**Compression**] [**Mechanical**] type, with a lug on the bar for each pole in the panelboard.

6. Feed-Through Lugs: **Mechanical** type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

7. Subfeed (Double) Lugs: **Mechanical** type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

8. Gutter-Tap Lugs: **Mechanical** type suitable for use with conductor material and with matching insulating covers. Locate at same end of bus as incoming lugs or main device.

I. Future Devices: Panelboards or load centers shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

1. Percentage of Future Space Capacity: Minimum **Ten** (10) percent.

J. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include label or manual with size and type of allowable upstream and branch devices listed and labeled by an NRTL for series-connected short-circuit rating.

1. Panelboards rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.

2. Panelboards rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

K. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.

2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

2.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2.4 POWER PANELBOARDS

A. Panelboards: NEMA PB 1, distribution type.

B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than **36 inches, (914 mm) 84 inches, (2.13m)** high, provide two latches, keyed alike.

C. Mains: **Fused switch**

D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: **Bolt-on circuit breakers**

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: **Bolt-on circuit breakers**

F. Branch Overcurrent Protective Devices: Fused switches.

1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.

2.5 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

B. Mains: **Circuit breaker or** [**lugs only**.

C. Branch Overcurrent Protective Devices: **Bolt-on** circuit breakers, replaceable without disturbing adjacent units.

D. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the

panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

2.6 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. MCCB: Comply with UL 489, with **interrupting capacity** to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

   a. Inverse time-current element for low-level overloads.
   b. Instantaneous magnetic trip element for short circuits.
   c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

3. Electronic Trip Circuit Breakers:

   a. RMS sensing.
   b. Field-replaceable rating plug or electronic trip.
   c. Digital display of settings, trip targets, and indicated metering displays.
   d. Multi-button keypad to access programmable functions and monitored data.
   e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
   f. Integral test jack for connection to portable test set or laptop computer.
   g. Field-Adjustable Settings:

      1) Instantaneous trip.
      2) Long- and short-time pickup levels.
      3) Long and short time adjustments.
      4) Ground-fault pickup level, time delay, and I squared T response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

5. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.

6. Subfeed Circuit Breakers: Vertically mounted.

7. MCCB Features and Accessories:

a. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handles in **on or off** position.
b. Handle Clamp: loose attachments, for holding circuit-breaker handle in on position.

B. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses and Spare-Fuse Cabinet: Comply with requirements specified in Section 262813 "Fuses."

2. Fused Switch Features and Accessories:

a. Standard ampere ratings and number of poles.
b. Mechanical cover interlocks with a manual interlock override, to prevent the opening of the cover when the switch is in the on position. The interlock shall prevent the switch from being turned on with the cover open. The operating handle shall have lock-off means with provisions for three padlocks.
c. Auxiliary Contacts: **one** normally open and normally closed contact(s) that operate with switch handle operation.

2.7 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in **metal frame with transparent protective cover**.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

D. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

2.8 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to **NEMA PB 1.1**.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to **NEMA PB 1.1**.

D. Equipment Mounting:

1. Install panelboards on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in **Section 033000 "Cast-in-Place Concrete."**

2. Attach panelboard to the vertical finished or structural surface behind the panelboard.

3. Comply with requirements for seismic control devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

G. Mount top of trim [**90 inches (2286 mm)**] <**ninty**> above finished floor unless otherwise indicated.

H. Mount panelboard cabinet plumb and rigid without distortion of box.

I. Mount surface-mounted panelboards to steel slotted supports **1 1/4 inch (32 mm)** in depth. Orient steel slotted supports vertically.

J. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

K. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

L. Install filler plates in unused spaces.

M. Arrange conductors in gutters into groups and bundle and wrap with wire ties **after completing load balancing**.

N. Mount spare fuse cabinet in accessible location.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads **after balancing panelboard loads**; incorporate Owner's final designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

D. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

E. Panelboards will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Engineer of effect on phase color coding.

1. Measure loads during period of normal facility operations.

2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.

3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.

4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

3.6 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

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SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Hospital-grade receptacles.
3. Tamper-resistant receptacles.
4. Weather-resistant receptacles.
5. Wall-switch and exterior occupancy sensors.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.

2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Hubble

B. Eaton

C. Leviton

D. Thomas

E. Pass & Seymour

F. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.

2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

B. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.

2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, feed-through type.

2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

C. Tamper-Resistant GFCI Convenience Receptacles, 125 V, 20 A:

2.5 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Single Pole:

1) Cooper; AH1221.
2) Hubbell; HBL1221.

3) Leviton; 1221-2.
4) Pass & Seymour; CSB20AC1.

b. Three Way:

1) Cooper; AH1223.
2) Hubbell; HBL1223.
3) Leviton; 1223-2.
4) Pass & Seymour; CSB20AC3.

2.6 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.

2. Material for Finished Spaces: Steel with white baked enamel, suitable for field painting.

3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.

4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant Thermoplastic with lockable cover.

2.7 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Engineer unless otherwise indicated or required by NFPA 70 or device listing.

2. Wiring Devices Connected to Emergency Power System: Red.

3. TVSS Devices: Blue.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.

2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.

4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.

2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

4. Existing Conductors:

a. Cut back and pigtail, or replace all damaged conductors.
b. Straighten conductors that remain and remove corrosion and foreign matter.
c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.

2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.

3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.

4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.

5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.

6. Use a torque screwdriver when a torque is recommended or required by manufacturer.

7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.

8. Tighten unused terminal screws on the device.

9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.

2. Verify that dimmers used for fan speed control are listed for that application.

3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.

2. Test Instruments: Use instruments that comply with UL 1436.

3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.

2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.

3. Ground Impedance: Values of up to 2 ohms are acceptable.

4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.

5. Using the test plug, verify that the device and its outlet box are securely mounted.

6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 262726

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SECTION 262813 - FUSES

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. Cartridge fuses rated 600 V ac and less for use in the following:

   a. Switchboards.
   b. Enclosed switches.

2. Spare-fuse cabinets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

   a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
   b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.

3. Current-limitation curves for fuses with current-limiting characteristics.

4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating

of fuse. Submit **in electronic format suitable for use in coordination software and in PDF format**.

5. Coordination charts and tables and related data.

6. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in **Section 017700 "Closeout Procedures," Section 017823 "Operation and Maintenance Data,"** include the following:

1. Ambient temperature adjustment information.

2. Current-limitation curves for fuses with current-limiting characteristics.

3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse used on the Project. Submit **in electronic format suitable for use in coordination software and n PDF format**.

4. Coordination charts and tables and related data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to **ten** (**10**) percent of quantity installed for each size and type, but no fewer than **three** (3) of each size and type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Cooper Bussman.

B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

B. 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.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

2.3 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with **fifteen** (**15**) percent spare capacity minimum.

2. Finish: Gray, baked enamel.

3. Identification: "SPARE FUSES" in 1-1/2-inch- (38-mm-) high letters on exterior of door.

4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

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

3.2 FUSE APPLICATIONS

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinet(s) in location shown on the Drawings or as indicated in the field by **Owner**.

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

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SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.

5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1. Test procedures used.

2. Test results that comply with requirements.

3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

B. Manufacturer's field service report.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

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. Comply with NFPA 70.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).

2. Altitude: Not exceeding 6600 feet (2010 m).

1.9 COORDINATION

A. Coordinate layout and installation of switches, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Type GD, General Duty, Single Throw, 600-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with **cartridge** fuse interiors to accommodate **specified** fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

B. Type HD, Heavy Duty, Single Throw, **600**-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate **specified** fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

2.2 NONFUSIBLE SWITCHES

A. Type GD, General Duty, Single Throw, 600-Vac 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

B. Type HD, Heavy Duty, Single Throw, **600**-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3. Perform the following infrared scan tests and inspections and prepare reports:

   a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
   b. follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
   c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges.

END OF SECTION 262816

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SECTION 263600 - TRANSFER SWITCHES

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 furnishing and installation of automatic transfer switches rated 600 V and less, including the following:

1. Automatic Double Throw power transfer switches NEMA 1 Enclosed.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

1. Single-Line Diagram: Show connections between transfer switch, , power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For **manufacturer**

B. Manufacturer Seismic Qualification Certification: Submit certification that transfers switches accessories, and components will withstand. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Features and operating sequences, both automatic and manual.

2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

B. Source Limitations: Obtain **automatic transfer switches** through one source from a single manufacturer.

C. 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.

D. Comply with NEMA ICS 1.

E. Comply with NFPA 70.

F. Comply with NFPA 99.

G. Comply with NFPA 110.

H. Comply with UL 1008 unless requirements of these Specifications are stricter.

1.7 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service:

1. Notify **Owner** no fewer than (2 two days in advance of proposed interruption of electrical service.

2. Do not proceed with interruption of electrical service without **Owner's** written permission.

1.8 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Contactor Transfer Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Emerson.
b. ASCO 7000 Series

B. Transfer Switches:

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on requirements according to UL 1008, IEC 60947-6-1, CSA 22.2 No. 78 – 1978 ATS, NEMA Standard ICS10-1993 and UL 58 Industrial Control Equipment.

C. Voltage, Frequency and phase rotation sensing shall be for; Under voltage N&E, 3PH – Dropout/Trip 70 to 98%, Pickup/ Reset 85 to 100%. Overvoltage N&E, 3PH – Dropout/Trip 102 to 115%, Dropout/Reset 2% below trip; Under frequency N & E Dropout/Trip 85 to 98%, Pickup/Reset 90 to 100%. Over frequency N & E Dropout/Trip 102 to 110, Pickup/Reset 2% below trip. Voltage unbalances N & E Dropout/Trip 5 to 20%, Pickup/Reset 1% below dropout. Source screens for the above shall be provided for both Normal and Emergency in either digital readout and provide Systems Status display with self-diagnostic features.

D. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus -20 to + 60 deg C.

E. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

F. Electrically operated, mechanically held Automatic (4) four pole Transfer Switch. The electrical operator shall be a momentary energized, single Solenoid mechanism.

G. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Molded Case Breakers or Main operators which include overcurrent disconnect devices, linear motors, gears will NOT BE ACCEPTABLE.

2. The switch shall be positively locked and unaffected by momentary outages, so that contact pressure is maintained at a constant value and contacts temperature rise is minimized for maximum reliability and operating life.

3. Contacts: Silver composition or silver alloy for load-current switching. Switches rated 800A and above shall have segmented, blow on construction for high withstand and close-on capability and protected by separate arching contacts.
4. The controller sensing logic shall be provid3d by a single built-in microprocessor for maximum reliability, minimum maintenance and the ability to communicate serially through an optional serial communication module.
5. A single controller shall provide twelve acceptable nominal voltages for maximum application, flexibility and minimal spare parts. Voltage sensing shall be true RMS type and shall be accurate to +/_1% of nominal voltage. Frequency sensing shall be accurate to +/_ 2%.

H. Neutral Terminal: Solid and fully rated.

I. Retain paragraph below if required for heavy nonlinear loads. This requirement may result in some suppliers' oversizing certain switches to provide an oversize neutral. Coordinate with Drawings.

J. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.

K. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Section 260553 "Identification for Electrical Systems."

1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.

2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.

3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

L. Enclosures: General-purpose NEMA 250, Type **1** complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110, 99, IEEE Standard 446.

B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated. Circuit Breakers and Dual Solenoid action not accepted.

C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

D. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.

E. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

F. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.

G. Automatic Closed-Transition Transfer Switches: Include the following functions and characteristics:

1. Fully automatic make-before-break operation.

2. Load transfer without interruption, through momentary interconnection of both power sources not exceeding 100 ms.

3. Initiation of No-Interruption Transfer: Controlled by in-phase monitor and sensors confirming both sources are present and acceptable.

a. Initiation occurs without active control of generator.
b. Controls ensure that closed-transition load transfer closure occurs only when the 2 sources are within plus or minus 5 electrical

degrees maximum, and plus or minus 5 percent maximum voltage difference.

4. Failure of power source serving load initiates automatic break-before-make transfer.

H. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer. Pause is adjustable from 0.5 to 30 seconds minimum and factory set for 0.5 second, unless otherwise indicated. Time delay occurs for both transfer directions. Pause is disabled unless both sources are live.

I. Automatic Transfer-Switch Features:

1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 70 to 98 percent of pickup value.

2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.

3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Pickup frequency shall be adjustable from 90 to 100 percent of nominal

4. Time Delay (Independently adjustable) for Retransfer to Normal Source: Adjustable from 0 to 60 minutes

5. Test Switch: Simulate normal-source failure.

6. Switch-Position LED indicating Lights: Indicate source to which load is connected.

7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

   a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
   b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.

9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power

source regardless of condition of normal source. Pilot light indicates override status.

10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.

11. Engine Shutdown Contacts: Instantaneous; shall initiate shutdown sequence at remote engine-generator controls after retransfer of load to normal source.

12. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.

13. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

    a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
    b. Push-button programming control with digital display of settings.
    c. Integral battery operation of time switch when normal control power is not available.

2.4 REMOTE ANNUNCIATOR SYSTEM

A. Functional Description: Remote annunciator panel shall annunciate conditions for indicated transfer switches. Annunciation shall include the following:

1. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.

2. Switch position.

3. Switch in test mode.

4. Failure of communication link.

B. Annunciator Panel: LED-lamp type with audible signal and silencing switch.

1. Indicating Lights: Grouped for each transfer switch monitored.

2. Label each group, indicating transfer switch it monitors, location of switch, and identity of load it serves.

3. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.

4. Lamp Test: Push-to-test or lamp-test switch on front panel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Floor-Mounting Switch: Anchor to floor by bolting.

1. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 4 inches (100 mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Section 260529 "Hangers and Supports for Electrical Systems."

B. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.

C. Identify components according to Section 260553 "Identification for Electrical Systems."

D. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS.

A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections **with the assistance of a factory-authorized service representative**:

1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

   a. Check for electrical continuity of circuits and for short circuits.
   b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
   c. Verify that manual transfer warnings are properly placed.
   d. Perform manual transfer operation.

4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.

   a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
   b. Simulate loss of phase-to-ground voltage for each phase of normal source.
   c. Verify time-delay settings.
   d. Verify pickup and dropout voltages by data readout or inspection of control settings.
   e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
   f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
   g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

   a. Verify grounding connections and locations and ratings of sensors.

D. Testing Agency's Tests and Inspections:

1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

   a. Check for electrical continuity of circuits and for short circuits.
   b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
   c. Verify that manual transfer warnings are properly placed.
   d. Perform manual transfer operation.

4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.

   a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
   b. Simulate loss of phase-to-ground voltage for each phase of normal source.
   c. Verify time-delay settings.
   d. Verify pickup and dropout voltages by data readout or inspection of control settings.
   e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
   f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
   g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

   a. Verify grounding connections and locations and ratings of sensors.

E. Coordinate tests with tests of generator and run them concurrently.

F. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

G. Prepare test and inspection reports.

H. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

3. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 DEMONSTRATION

A. **Engage a factory-authorized service representative to train** Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 263600

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SECTION 265000 - INTERIOR AND EXTERIOR LIGHTING

PART 2 - 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. Interior lighting fixtures, lamps, and ballasts.

2. Exit signs.

3. Lighting fixture supports.

B. Related Sections:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Section 262726 "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CCT: Correlated color temperature.

C. CRI: Color-rendering index.

D. LER: Luminaire efficacy rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.

2. Ballast, including BF.

3. Energy-efficiency data.

4. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.

5. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

a. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom lighting fixtures. 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. Wiring Diagrams: For power, signal, and control wiring.

C. Samples: For each lighting fixture indicated in the Interior Lighting Fixture Schedule. Each Sample shall include the following:

1. Lamps and ballasts, installed.

2. Cords and plugs.

3. Pendant support system.

D. Installation instructions.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Lighting fixtures.

2. Air outlets and inlets.

3. Sprinklers.

B. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

C. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting equipment and fixtures to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.

2. Plastic Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.

3. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.

C. 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.

D. Comply with NFPA 70.

1.9 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings provide one of the products indicated on Drawings available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

B. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

F. Diffusers:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
b. UV stabilized.

G. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

   a. "USE ONLY" and include specific lamp type.
   b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
   c. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
   d. CCT and CRI for all luminaires.

H. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. General Requirements for Electronic Ballasts:

1. Comply with UL 935 and with ANSI C82.11.

2. Designed for type and quantity of lamps served.

3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.

4. Sound Rating: Class A Class A except Class B for T12/HO and T12/Slimline lamp ballasts.

5. Total Harmonic Distortion Rating: Less than 10 20 percent.

6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.

7. Operating Frequency: 42 kHz or higher.

8. Lamp Current Crest Factor: 1.7 or less.

9. BF: 0.9 or higher.

10. Power Factor: 0.95 0.98 or higher.

11. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

B. Luminaires controlled by occupancy sensors shall have programmed-start ballasts.

C. Electronic Programmed-Start Ballasts for T5 T8 T5HO T5 and T5HO Lamps: Comply with ANSI C82.11 and the following:

1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.

2. Automatic lamp starting after lamp replacement.

D. Single Ballasts for Multiple Lighting Fixtures: Factory wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.

E. Ballasts for Low Electromagnetic-Interference Environments: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for consumer equipment.

F. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.

1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.

a. High-Level Operation: 100 percent of rated lamp lumens.
b. Low-Level Operation: 30 percent of rated lamp lumens.

2. Ballast shall provide equal current to each lamp in each operating mode.

3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

2.4 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: Fluorescent, two for each fixture, 20,000 hours of rated lamp life.

2. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.

2.5 FLUORESCENT LAMPS

A. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches (1220 mm), 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours unless otherwise indicated.

B. T5 rapid-start lamps, rated 28 W maximum, nominal length of 45.2 inches (1150 mm), 2900 initial lumens (minimum), CRI 85 (minimum), color temperature 3000 K, and average rated life of 20,000 hours unless otherwise indicated.

C. T5HO rapid-start, high-output lamps, rated 54 W maximum, nominal length of 45.2 inches (1150 mm), 5000 initial lumens (minimum), CRI 85 (minimum), color temperature 4100 K, and average rated life of 20,000 hours unless otherwise indicated.

2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).

F. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.

2. Install lamps in each luminaire.

B. Temporary Lighting: If it is necessary, and approved by Engineer, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete,

remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.

2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.

3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.4 STARTUP SERVICE

A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner.

END OF SECTION 265000

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SECTION 283112 - FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.2 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. System smoke detectors.
3. Smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Device guards.
7. Remote annunciator.
8. Electrical power supply

B. Related Requirements:

1. 260519 "Conductors and Cables for Low Voltage" for cables and conductors for fire-alarm systems.

1.3 DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. FACP: Fire Alarm Control Panel.

C. NICET: National Institute for Certification in Engineering Technologies.

D. VESDA: Very Early Smoke Detection Apparatus.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, and profiles and finishes.

2. Include rated capacities, operating characteristics, and electrical characteristics.

B. Shop Drawings: For fire-alarm system.

1. Comply with current FA system vendor requirements for the modification of existing system, recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.

2. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.

3. Detail assembly and support requirements.

4. Include battery size calculations.

5. Include input/output matrix.

6. Include statement from existing vendor/manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.

7. Include performance parameters and installation details for each detector.

8. Verify that each duct smoke detector is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.

9. Provide program report showing that air-sampling detector pipe layout balances pneumatically within the airflow range of the air-sampling detector.

   a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
   b. Show field wiring required for HVAC unit shutdown on alarm.
   c. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' control system.
   d. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' smoke-evacuation system.
   e. Locate detectors according to manufacturer's written recommendations.
   f. Show air-sampling detector pipe routing.

10. Include floor plans to indicate final outlet locations showing zone or designation of each device. Show size and route of cable and conduits and point-to-point wiring diagrams.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Engineer.

2. Shop Drawings shall be prepared by persons with the following qualifications:

   a. Trained and certified by manufacturer in fire-alarm system design.
   b. NICET-certified fire-alarm technician; **Level IV** minimum.
   c. Licensed or certified by authorities having jurisdiction. Secure FDNY inspections and approvals.

D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.

2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.

3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following **and deliver copies to authorities having jurisdiction**:

a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
b. Provide the "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
d. Riser diagram as applicable.
e. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.
f. Record copy of site-specific software.
g. Provide the "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

    1) Equipment tested.
    2) Frequency of testing of installed components.
    3) Frequency of inspection of installed components.
    4) Requirements and recommendations related to results of maintenance.
    5) Manufacturer's user training manuals.

h. Maintain and assurance of Manufacturer's required maintenance related to system warranty requirements.
i. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Smoke and Fire Detectors: Quantity equal to **ten** (**10**) percent of amount of each type installed, but no fewer than one unit of each type.

2. Keys and Tools: One extra set for access to lock or tamperproof components.

3. Audible and Visual Notification Appliances: **One (1)** of each type installed.

4. Fuses: **Two** (**2)** of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm technician.

C. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).

D. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

1.9 PROJECT CONDITIONS

A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.

B. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify **Owner** no fewer than **seven** (7) days in advance of proposed interruption of fire-alarm service.

2. Do not proceed with interruption of fire-alarm service without **Owner's** written permission.

C. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

1.10 SEQUENCING AND SCHEDULING

A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service, and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.

B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.

1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.

2. Warranty Period: **Five** (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. All components provided shall be listed for use with the existing system.

B. 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.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Existing Fire-alarm signal initiation is by one or more of the following devices

1. Manual stations.

2. Heat detectors.

3. Smoke detectors.

4. Duct smoke detectors.

5. Air-sampling smoke-detection system (VESDA).

6. Automatic sprinkler system water flow.

7. Fire-extinguishing system operation.

8. Fire standpipe system.

9. Dry system pressure flow switch.

10. Fire pump running.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.

2. Identify alarm zone or addressable device at fire-alarm control unit **and remote annunciators**.

3. Transmit an alarm signal to the remote alarm receiving station.

4. Unlock electric door locks in designated egress paths.

5. Release fire and smoke doors held open by magnetic door holders.

6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.

7. Activate smoke-control system (smoke management) at firefighters' smoke-control system panel.

8. Close smoke dampers in air ducts of designated air-conditioning duct systems.

9. Activate elevator power shunt trip.

10. Record events in the system memory.

11. Record events by the system printer.

12. Indicate device in alarm on the graphic annunciator.

C. Supervisory signal initiation shall be by one or more of the following devices and systems:

1. Alert and Action signals of air-sampling detector system.

2. User disabling of zones or individual devices.

3. Loss of communication with any panel on the network.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.

2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.

E. System Trouble and Supervisory Signal Actions:

1. Initiate notification appliances.

2. Annunciate at fire-alarm control unit **and remote annunciators**.

3. Record the event on system printer.

4. Transmit system status to building management system.

2.3 FIRE-ALARM CONTROL UNIT

A. Adjust existing system and Fire-Alarm Control Unit.

B. Smoke-Alarm Verification:

1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.

2. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.

3. Record events by the system printer.

4. Sound general alarm if the alarm is verified.

5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.

C. Notification-Appliance Circuit: Operation shall sound an alarm and operate the as required by the authorities having jurisdiction.

D. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls connected to fire-alarm system.

E. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

F. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for zone, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

G. Primary Power: It is assumed 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, **supervisory signals** shall be powered by the 24-V dc source.

1. Alarm current draw of the entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

H. Secondary Power: 24-V dc supply system with batteries rated for 90 minutes at 100% operation and, automatic battery charger, are on emergency power via automatic transfer switch.

2.4 SYSTEM SMOKE DETECTORS

A. Match new for System Smoke Detectors:

1. Operating at 24-V dc, nominal.

2. Detectors shall be [**four**] [**two**]-wire type.

B. Ionization Smoke Detector: Comply with UL 268.

C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Remote indication **and test** station.

2. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.

3. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

D. Description: Listed for connection to fire-alarm system.

1. Mounting: Adapter plate for outlet box mounting.

2. Detector shall provide alarm contacts and trouble contacts.

3. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.

4. Detector shall be listed to comply with UL 2075.

5. Detectors shall be located, mounted, and wired according to manufacturer's written instructions.

2.5 NONSYSTEM SMOKE DETECTORS

2.6 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.

C. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.

2.7 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.

1. Factory fabricated and furnished by device manufacturer.

2. Finish: Paint of color to match the protected device.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine existing Fire Alarm Systems. Contact existing vendor and secure their proposal to provide the work associated with this installation. Examine areas and conditions for compliance with requirements for the alarm works, related ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

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

3.2 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

B. Connecting to Existing Equipment: Secure the involvement of current Fire Alarm vendor. Verify that existing fire-alarm system is operational before making changes or connections.

1. Connect new equipment to the existing control panel in the existing part of the building.

2. Connect new equipment to the existing monitoring equipment at the supervising station.

3. Expand, modify, and supplement the existing **control, monitoring** equipment as necessary to extend the existing **control**, **monitoring** functions to the new points. New components shall be capable of merging with the existing configuration without degrading the performance of either system.

C. Install per code wall-mounted equipment.

D. Smoke Spacing:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.

2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.

3. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to NFPA 72.

E. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place, except during system testing. Remove cover prior to system turnover.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

F. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

G. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling. Install all devices at the same height unless otherwise indicated.

3.3 PATHWAYS

A. Exposed EMT shall be painted red enamel.

3.4 CONNECTIONS

A. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

B. Connect supervised interface devices to the following devices and systems. Install the interface device less than 36 inches (910 mm) from the device controlled.

1. Smoke dampers in air ducts of designated HVAC duct systems.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.6 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.7 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by **Existing Fire Alarm Vendor** representative and special inspection engineer.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections **with the assistance of a factory-authorized service representative**:

1. Visual Inspection: Conduct the visual inspection prior to testing.

   a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
   b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing, and Maintenance" chapter in NFPA 72.

3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.

4. Test visible appliances for the public operating mode according to manufacturer's written instructions.

5. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

H. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with the visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.8 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include **twelve** (**12**) months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

3. Perform tests listed in the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 283112

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