Contract Documents
for
Screening Improvements Project

Contract No. RFB-RC-SWR-2023-06

SRF Project No. C3-5368-35-00

Rockland County Sewer District No. 1
Rockland County, New York

NEW YORK STATE | Environmental Facilities Corporation

TECHNICAL SPECIFICATIONS

FOR BID
JUNE 2024

STATE OF NEW YORK
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SECTION 01 11 00

SUMMARY OF WORK

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Summary
2. Location and Description of Work
3. Construction Contracts, This Project
4. Construction Contracts, Other Projects
5. Work by Others (Not Used)
6. Work by Owner
7. Owner Furnished Equipment and Materials
8. Owner Assigned Procurement Contracts
9. Owner Pre-selected Equipment and Materials
10. Sequence and Progress of Work
11. Contractor's Use of Site
12. Easements and Rights-of-Way
13. Notices to Owners and Authorities of Properties Adjacent to the Work
14. Salvage of Equipment and Materials
15. Partial Utilization by Owner

B. Related Sections:

1. Section 01 14 00 – Coordination with Owner's Operations

1.02 LOCATION AND DESCRIPTION OF WORK

A. The Work is located at the following Site:

1. Rockland County Sewer District No. 1, Orangeburg Wastewater Treatment Plant, 4 Route 340, Orangeburg, NY 10962

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B. The Work to be performed under this Contract includes, but is not limited to, constructing the Work described below and all appurtenances related to the Work. The Work shall be as follows:

1. Replacement of climber type mechanical screens with three (3) multi-rake type bar screens.

2. Replacement of serpentine type belt conveyor with screw screenings conveyor.

3. Installation of new screenings compactor.

4. Construction of new Compactor Room building adjacent to existing Screen Building, consisting of a reinforced concrete spread footing, reinforced concrete slab on grade, combination concrete and concrete masonry unit (CMU) block walls with a brick façade, and reinforced concrete roof slab and roof beams.

5. Site grading and replacement of the asphalt driveway to the new Compactor Room.

6. Rehabilitation of the existing Screening Loading Area for use as an equipment storage and maintenance area.

7. Replacement of 2-inch bypass bar racks with 1-inch bar racks.

8. Replacement of slide gates.

9. Installation of stop logs, guides, and storage racks.

10. Replacement of gas detection system.

11. Replacement of lighting.

12. Replacement of facility doors and windows.

13. Sandblast and coating of existing structural roof beams.

14. Replacement of Screen Building HVAC system including ventilation supply and exhaust fans, louvers, ductwork, unit heaters, and controls.

1.03 CONSTRUCTION CONTRACTS, THIS PROJECT

A. The Contracts under which the Project will be constructed are:

1. Work specified in Divisions 01 through 46 (inclusive) of the Specifications.

2. Work shown on sheets 1 through 85 (inclusive) of the Drawings.

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1.04 CONSTRUCTION CONTRACTS, OTHER PROJECTS

A. Sludge Thickeners Upgrade Project

B. Sludge Dewatering Upgrade Project

C. Odor Control Upgrade Project

D. Main Pump Station Upgrade Project

1.05 WORK BY OTHERS (NOT USED)

1.06 WORK BY OWNER

A. Owner will perform the following in connection with the Work: Operate all existing valves, gates, pumps, equipment, and appurtenances that will affect Owner's operation, unless otherwise specified or indicated.

1.07 OWNER-FURNISHED EQUIPMENT AND MATERIALS (NOT USED)

1.08 OWNER ASSIGNED PROCUREMENT DOCUMENTS (NOT USED)

1.09 OWNER PRE-SELECTED EQUIPMENT AND MATERIALS (NOT USED)

1.10 SEQUENCE AND PROGRESS OF WORK

A. Requirements for sequencing and coordinating with Owner's operations, including maintenance of plant operations during construction, and requirements for tie-ins and shutdowns, are in Section 01 14 00 – Coordination with Owner's Operations.

1.11 CONTRACTOR'S USE OF SITE

A. Contractors' use of the Site shall be as required in General Contract Conditions and Special Contract Conditions. Contractors shall share use of the Site with other contractors and others specified in this Section.

B. Contractor shall move stored products that interfere with operations of Owner, other contractors, or others performing work for Owner.

C. Areas to be used by the Contractor are to be as directed by the Owner.

1.12 EASEMENTS AND RIGHTS-OF-WAY

A. Easements and rights-of-way will be provided by Owner in accordance with the General Contract Conditions. Confine construction operations to within Owner's property, public rights-of-way, easements obtained by Owner, and the limits shown. Use care in placing construction tools, equipment, excavated materials, and products to be incorporated into

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the Work to avoid damaging property and interfering with traffic. Do not enter private property outside the construction limits without permission from the owner of the property.

1.13 NOTICES TO OWNERS AND AUTHORITIES OF PROPERTIES ADJACENT TO THE WORK

A. Notify owners of adjacent property and utilities when execution of the Work may affect their property, facilities, or use of property.

B. When it is necessary to temporarily obstruct access to property, or when utility service connection will be interrupted, provide notices sufficiently in advance to enable affected persons to provide for their needs. Conform notices to Laws and Regulations and, whether delivered orally or in writing, include appropriate information concerning the interruption and instructions on how to limit inconvenience caused.

C. Notify utility owners and other concerned entities at least 48 hours prior to cutting or closing streets or other traffic areas or excavating near Underground Facilities or exposed utilities.

1.14 SALVAGE OF EQUIPMENT AND MATERIALS

A. Existing equipment and materials removed and not shown or specified to be reused in the Work will be Contractor’s property.

B. Existing equipment and material removed by Contractor shall not be reused in the Work, except where specified or indicated.

C. Contractor shall carefully remove in manner to prevent damage all equipment and materials specified or indicated to be salvaged and reused. Store and protect salvaged items specified or indicated to be used in the Work. Replace in kind or with new items equipment, materials, and components damaged in removal, storage, or handling through carelessness or improper procedures.

D. Contractor may furnish and install new items, with Engineer’s approval, instead of those specified or indicated to be salvaged and reused, in which case such removed items will become Contractor’s property.

1.15 PARTIAL UTILIZATION BY OWNER

A. Owner reserves the right to enter and use portions of the Work prior to Certificate of Substantial Completion is issued by Engineer.

B. Owner shall be responsible to prevent premature connections by private and public parties, persons or groups of persons, before Engineer issues Certificate of Substantial Completion for the portion of Work being partially utilized by Owner.

C. Contractor shall cooperate with Owner, Owner's agents, and Engineer to accelerate completion of Work designed for partial utilization by Owner in accordance with Contractor's progress schedule.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 14 00

COORDINATION WITH OWNER'S OPERATIONS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Requirements for coordinating with Owner's operations during the Work and included requirements for tie-ins and shutdowns necessary to complete the Work without impact on Owner's operations, except as allowed in this Section.

2. Contractor shall provide labor, materials, tools, equipment, and incidentals shown, specified, and required to coordinate with Owner's operations during the Work.

B. General Requirements:

1. Except for shutdowns specified in this Section, perform the Work such that the Owner's facility remains in continuous satisfactory operation during the Project. Schedule and conduct the Work such that the Work does not: impede Owner's production or processes, create potential hazards to operating equipment and personnel, reduce the quality of the facility's products or effluent, or cause odors or other nuisances.

2. Work not specifically covered in this Section or in referenced Sections may, in general, be completed at any time during regular working hours in accordance with the General Contract Conditions and Special Contract Conditions, subject to the requirements in this Section.

3. Contractor has the option of providing additional temporary facilities that can eliminate or mitigate a constraint without additional cost to Owner, provided such additional temporary facilities: do not present hazards to the public, personnel, structures, and equipment; that such additional temporary facilities do not adversely affect Owner's ability to comply with Laws and Regulations, permits, and operating requirements; that such temporary facilities do not generate or foster the generation of odors and other nuisances; and that requirements of the Contract Documents are fulfilled.

4. Coordinate shutdowns with Owner and Engineer. When possible, combine multiple tie-ins into a single shutdown to minimize impacts on Owner's operations and processes.

5. Do not shut off or disconnect existing operating systems, unless accepted by the Engineer in writing. Operation of existing equipment will be by the Owner unless otherwise specified or indicated. Where necessary for the Work, Contractor shall seal or bulkhead Owner-operated gates and valves to prevent leakage that may affect the Work, Owner's operations, or both. Provide temporary watertight plugs,

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bulkheads, and line stops as required. After completing the Work, remove seals, plugs, bulkhead, and line stops to satisfaction of Engineer.

C. Continuous Treatment Provision:

1. Federal regulations prohibit bypassing of untreated or partially treated wastewater or sewage during construction Work.

2. Contractor shall provide labor, equipment, materials, and incidentals to provide continuous treatment to the level prior to construction Work.

3. Contractor shall be responsible for providing temporary pumping facilities, systems, piping, valve, appurtenances, equipment, materials, and temporary utilities necessary to complete the Work without treatment bypassing.

D. Related Sections:

1. Section 01 11 00 – Summary of Work

2. Section 01 25 00 – Substitution Procedures

3. Section 01 73 00 – Demolition and Execution of Work

1.02 REFERENCES

A. Definitions: A "shutdown" is when a portion of the normal operation of Owner's facility, whether equipment, systems, piping, or conduit, has to be temporarily suspended or taken out of service to perform the Work.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Review installation procedures under other Specification Sections and coordinate Work that must be performed with or before the Work specified in this Section.

2. Notify other contractors in advance of Work requiring coordination with Owner's operations, to provide other contractors sufficient time for work included in their contracts that must be installed with or before Work specified in this Section.

3. When possible, combine multiple tie-ins into a single shutdown to minimize impacts on Owner's operations and processes.

B. Pre-Shutdown Meetings: Contractor shall schedule and conduct meeting with Owner and Engineer 1 week prior to scheduling shutdown.

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C. Sequencing:

1. Perform the Work in the specified sequence. Certain phases or stages of the Work may require working 24-hour days or work during hours outside of regular working hours. Work may be accelerated from a later stage to an earlier stage if Owner's operations are not adversely affected by proposed sequence change, with Engineer's acceptance. Stages specified in this Section are sequential in performance of the Work.

D. Scheduling:

1. Work that may interrupt normal operations shall be accomplished at times convenient to Owner.

2. Furnish at the Site, in close proximity to the shutdown and tie-in work areas, tools, equipment, spare parts and materials, both temporary and permanent, necessary to successfully complete the shutdown. Complete to the extent possible, prefabrication of piping and other assemblies prior to the associated shutdown Demonstrate to Engineer's satisfaction that Contractor has complied with these requirements before commencing the shutdown.

3. If Contractor's operations cause an unscheduled interruption of Owner's operations, immediately re-establish satisfactory operation for Owner.

4. Unscheduled shutdowns or interruptions of continued safe and satisfactory operation of Owner's facilities that result in fines or penalties by authorities having jurisdiction shall be paid solely by Contractor if, in Engineer's opinion, Contractor did not conform to the requirements of the Contract Documents, or was negligent in the Work, or did not exercise proper precautions in conducting the Work.

5. Work requiring service interruptions for tie-ins shall be performed during scheduled shutdowns.

6. Temporary, short-term shutdowns of smaller piping, conduits, equipment, and systems may be required. Coordinate requirements for such shutdowns with Engineer and Owner.

1.04 SUBMITTALS

A. Action/Informational Submittals:

1. Substitute Sequence Submittal: When deviation from specified sequence is proposed, provide submittal explaining in detail the proposed sequence change and its effects, including evidence that Owner's operations will not be adversely affected by proposed change. List benefits of proposed sequence change, including benefits to Progress Schedule. Submit in accordance with Section 01 25 00 – Substitution Procedures.

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B. Emergency Flow Bypass Plan

1. Contractor shall prepare and submit an Emergency Plant Flow Bypass Plan for Engineer's approval.

    a. Plan shall include detailed emergency bypass procedures to bypass plant flow to the Bypass Bar Rack Channels, which shall include but not limited to:

        1) Identify and locate equipment and their associated electrical and control equipment needed to achieve emergency bypass.

        2) List any temporary equipment needed to achieve emergency bypass. Temporary equipment shall be furnished and installed at no additional cost to the Owner.

        3) Figures showing the locations of the equipment.

        4) Operations of the required equipment to achieve emergency bypass.

        5) Communication protocol with personnels and their contact information when emergency bypass occurred.

    b. Plan shall include verification of the condition of the slide gates in Chamber 1 and Chamber 2 that direct plant flow to either Mechanical Screen Room or to Bar Rack Channels. A report of the slide gates condition shall be submitted along with the Plan.

C. Shutdown Planning Submittal:

1. For each shutdown, submit an inventory of labor and materials required to perform the shutdown and tie-in tasks, an estimate of time required to accomplish the complete shutdown including time for Owner to take down and start up existing equipment, systems, or conduits, and written description of steps required to complete the Work associated with the shutdown.

2. Furnish submittal to Engineer at least thirty (30) days prior to proposed shutdown start date. Do not start shutdown until obtaining Engineer's acceptance of shutdown planning submittal.

3. Shutdown Notification: After acceptance of shutdown planning submittal and prior to starting the shutdown, provide written notification to Owner and Engineer of date and time each shutdown is to start. Provide notification at least 72 hours in advance of each shutdown.

1.05 SITE CONDITIONS

A. General Constraints: Specified in the Contract Documents are the sequence and shutdown durations, where applicable, for Owner's equipment, systems, and conduits that are to be taken out of service temporarily for the Work. New equipment, materials, and systems may be used by Owner after the specified field quality controls and testing are successfully completed and the materials or equipment are Substantially Complete.

B. The Contractor shall not remove any items from service without written permission from Owner. Upon receiving written approval from the Owner, the Contractor shall proceed with the Work and shall proceed continuously until the Work is completed, tested, and made ready for operation.

C. The following constraints apply to coordination with Owner's operations:

1. Operational Access: Owner's personnel shall have access to equipment and areas that remain in operation.

2. Schedule and perform equipment and system start-ups for Monday through Thursday. Equipment and systems shall not be placed into operation on Friday, Saturday, and Sunday without prior approval of Owner.

3. Dead End Valves or Pipe: Provide blind flanges, watertight bulkheads, or valves at temporary and permanent terminuses of pipes and conduits. Blind flanges and bulkheads shall be suitable for the service and braced and blocked, as required, or otherwise restrained as directed by Engineer. Temporary valves shall be suitable for their associated service. Where valve is provided at permanent terminus of pipe or conduit, also provide on downstream side of valve a blind flange with drain/flushing connection.

4. Contractor shall dewater process tanks, channels, basins, conduits, and other work areas to be dewatered for shutdowns. Maintain clean and dry work area by pumping and properly disposing of fluid that accumulates in work areas.

    a. The Contractor is advised that existing valves, gates and other devices shall be considered as inoperable and subject to leaking. The Contractor shall be responsible for designing, furnishing, installing and removing all temporary devices, stop logs, plugs or bulkheads necessary to isolate or dewater pipes, channels, conduits, or tanks to perform the Work.

5. Draining and Cleaning of Conduits, Tanks, channels, and Basins: Unless otherwise specified, Contractor will dewater process tanks and basins at beginning of each shutdown. Contractor will flush and wash down tanks and basins with plant non-potable water. Draining and cleaning conducted by Contractor shall be as specified below:

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a. Contractor shall remove liquids and solids and dispose of them at appropriate location at the Site as directed by Engineer. Contents of pipes, tanks, basins, and conduits undergoing modifications shall be transferred to existing process tanks or conduits at the Site with capacity sufficient to accept such discharges, using hoses, piping, pumps, or other means provided by Contractor. Discharge of fluids across floors is not allowed.

b. If drainage point is not available on the piping or conduit to be drained, provide a wet tap using tapping saddle and valve or other method approved by Engineer. Uncontrolled spillage of pipe's or conduit's contents is not allowed.

c. Spillage shall be brought to Engineer's attention immediately, both verbally and in writing, and reported in accordance with Laws and Regulations. Contractor shall wash down spillage to floor drains or sumps and flush the system to prevent clogging and odors. If spillage is not suitable for discharge to the drainage system, such as chemical spills, as determined by Engineer, Contractor shall remove spillage by other method, such as vactor truck, acceptable to Engineer.

6. Electrical, Control, Communication, and Monitoring Systems:

a. Owner's existing SCADA system and fiber optic network shall remain functional, subject to the constraints herein.

b. Each process area shall be permitted to have a single, non-concurrent, scheduled outage for the purpose of making electrical tie-ins, PLC panel hardware modifications, loading the associated PLC logic, and its field testing/demonstration. Field testing and demonstration shall immediately follow modifications keep scheduled shutdowns as short as possible. A 14-day day period of no SCADA outage shall proceed each scheduled shutdown.

7. Refer to additional constraints in Article 3.03.

1.06 SUGGESTED SEQUENCE OF WORK

A. Perform the Work in the specified sequence or as otherwise approved by Engineer. Certain phases or stages of the Work may require working 24-hour days or work during hours outside of regular working hours. Work may be accelerated from a later stage to an earlier stage if Owner's operations are not adversely affected by proposed sequence change, and with Engineer's acceptance. Stages specified in this Section are sequence-dependent.

1. Stage 1: Mobilization

2. Stage 2: Compactor Room and Bar Rack Upgrades

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a. Site Work

1) Site Clearing & Grubbing

2) Install Stormwater & Erosion Controls

3) Install Site Grading

4) Construct Temp/Site Access Roadway & Parking Lot

5) Install Storm Water Controls & Yard Process Piping

6) Excavation for Compactor Room

b. Bar Rack Channels Area

1) Demolition

2) Channel Structure

3) Mechanical Installation

c. Compactor Room

1) Construct new Compactor Room

2) "Rough-in" Electrical and Controls

3) Mechanical Installation

4) Complete Electrical and Controls

3. Stage 3: First Two Screen Channels

a. Screen Room - Channel 3:

1) "Rough-in" Electrical and Controls

2) Remove from service

3) Demolition

4) Channel Structure

5) Mechanical Installation

6) Complete Electrical and Controls

7) Testing, Start-up & Commissioning

b. Screen Room - Channel 2

1) "Rough-in" Electrical and Controls

2) Remove from service

3) Demolition

4) Channel Structure

5) Mechanical Installation

6) Complete Electrical and Controls

7) Testing, Start-up & Commissioning

4. Stage 4: Final Screen Channel and Conveyor

a. Screen Room - Channel 1

1) "Rough-in" Electrical and Controls

2) Remove from service

3) Demolition

4) Channel Structure

5) Mechanical Installation

6) Complete Electrical and Controls

7) Testing, Start-up & Commissioning

b. Screen Room and Compactor Room

1) "Rough-in" Conveyor Electrical and Controls

2) Remove conveyor from service

3) Demolition

4) Conveyor installation.

5) Complete Electrical and Controls

6) Testing, Start-up & Commissioning including Compactor

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1.07 TIE-INS

A. Contractor shall perform tie-ins required to complete the Work and obtain requirements for tie-ins from Engineer.

1.08 SHUTDOWNS

A. General:

1. Work that may interrupt normal operations shall be accomplished at times convenient to Owner.

2. Furnish at the Site, in close proximity to the shutdown and tie-in work areas, tools, equipment, spare parts and materials, both temporary and permanent, necessary to successfully complete the shutdown. Complete to the extent possible, prefabrication of piping and other assemblies prior to the associated shutdown. Demonstrate to Engineer's satisfaction that Contractor has complied with these requirements before commencing the shutdown.

3. If Contractor's operations cause an unscheduled interruption of Owner's operations, immediately re-establish satisfactory operation for Owner.

4. Unscheduled shutdowns or interruptions of continued safe and satisfactory operation of Owner's facilities that result in fines or penalties by authorities having jurisdiction shall be paid solely by Contractor if, in Engineer's opinion, Contractor did not conform to the requirements of the Contract Documents, or was negligent in the Work, or did not exercise proper precautions in conducting the Work.

5. Work requiring service interruptions for tie-ins shall be performed during scheduled shutdowns.

6. Contractor shall coordinate requirements for temporary, short-term shutdowns of smaller piping, conduits, equipment, and systems with Engineer and Owner.

B. Treatment Process Shutdown and Site Access Constraints:

1. Owner shall have the following unit processes and equipment operational at all times during the Project, unless specified herein:

   a. Main plant flow via a minimum of two screen channels

   b. Screenings conveyance

2. Owner shall have roadway access at the site.

C. Shutdowns of Electrical Systems: Comply with Laws and Regulations, including the National Electric Code. Contractor shall lock out and tag circuit breakers and switches

operated by Owner and shall verify that affected cables and wires are de-energized to ground potential before shutdown Work is started. Upon completion of shutdown Work, remove the locks and tags and notify Engineer that facilities are available for use.

D. Shutdowns of Communications, SCADA, and Networking:

1. SCADA outages shall be approved by the Engineer and shall be coordinated with and scheduled at times suitable to the Owner.

1.09 EMERGENCY PLANT FLOW BYPASS

A. Contractor shall maintain full plant flow of 80 MGD through the mechanical screens to the plant's main pump station at all times unless unanticipated equipment failures or construction conditions (e.g., failure of bar screen in Channel 2 during construction of Channel 3) that result in reduced flow capacity through the mechanical bar screens.

B. If directed by Owner or Engineer, Contractor shall be allowed to bypass a portion or all of plant flow to the Bar Rack Channel to restore full plant flow capacity from unanticipated equipment failures or construction conditions as described above.

C. Contractor shall be responsible for monitoring, cleaning, and transport of screenings (maximum of 40 cf/hr) from the Bar Rack to the dumpster on a 24/7 basis for the duration of the emergency bypass, unless otherwise directed by the Owner.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 GENERAL

A. In addition to requirements of this Section, conform to requirements of Section 01 73 00 – Demolition and Execution of Work.

3.02 DETAILED SHUTDOWN REQUIREMENTS:

A. Prior to Typical Shutdown:

1. Obtain Engineer's acceptance of proposed shutdown planning submittal and shutdown notification submittal.

2. Submittal and approval of all shop drawings required.

3. Schedule pre-shutdown meeting, coordinate with plant operations on timing of shutdown, and provide required notice to Owner.

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4. Bring necessary piping, couplings, valves, equipment, and appurtenances to the work areas.

5. Assist Owner in preparing to take equipment, tanks, basins, and conduits temporarily out of service.

6. Coordinate other tie-ins to be performed simultaneously.

7. Install and ensure functionality of temporary systems as applicable.

B. During Typical Shutdown:

1. Contractor shall dewater tanks, channels, and basins.

2. Remove existing equipment, piping, and accessories as required.

3. Verify operation of new equipment, materials, and systems.

4. Following approval from Engineer, return equipment and system to operation with Owner.

C. Following Typical Shutdown:

1. Verify functionality of equipment and system.

2. Verify operation of new equipment and systems and verify that joints in piping are watertight or gastight as applicable.

3. Repair joints that are not watertight or gastight as applicable.

4. Remove temporary systems as applicable.

3.03 PROPOSED SHUTDOWN

A. In order to maintain continuous operation during construction a phased construction sequence shall be required as described herein. Specific constraints are outlined for each Item. These steps and time constraints are intended as recommended sequencing and timing for specific activities related to that particular Item. The Contractor may present alternate construction plans for consideration by the Engineer as specified herein. These steps are not intended as explicitly sequential, in several instances, steps may be performed concurrently to execute the Work within allotted time constraints.

B. Screenings Conveyor: The existing Screenings Conveyor shall remain in service until all work in the first two screening channels has been completed and accepted by the owner. New Screens shall be interlocked with the existing Screenings Conveyor to provide a complete and fully functional, automated screenings system at the time each channel is turned over to the owner, until such time the existing Screenings Conveyor is

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removed and new Screenings Conveyor installation completed according to the contract documents.

C. Constraints and requirements:

SCHEDULE 01 14 00 – 1: CONSTRAINTS AND REQUIREMENTS – BAR RACK AREA		
1	General Work Summary	Phased, coordinated upgrade of four bar rack channels, including but not limited to: A. Installation of stop log guides to allow wet well isolation B. Replacement of bar rack in each channel
2	Operational Requirements	A. Plant flow capacity must be maintained
3	Constraints	A. Main Sewage Pump Station Wet Well shall maintain in service at all times, except as provided below. B. One side of the Main Sewage Pump Station Wet Well may be briefly removed from service when the wet well entry is required to install stop log guides. This work shall only be permitted during dry weather when the meteorological forecast for the drainage area predicts no more than 10% hourly chance of precipitation for the planned duration of the work. The Contractor shall work three shifts until both side of the Wet Well is returned to service.
4	Duration Limitations	See constraints above and shall not exceed 48 hours.

SCHEDULE 01 14 00 – 2: CONSTRAINTS AND REQUIREMENTS – SCREENING CHANNELS		
1	General Work Summary	Phased, coordinated upgrade of each of three screen channels, including but not limited to: A. Demolition, cleaning, and rehabilitation of concrete B. Installation of stop log guides C. Replacement of influent and effluent slide gates D. Replacement of bar screens and instruments
2	Operational Requirements	A. Full flow capacity must be maintained B. Equipment serving operational channels shall remain operational and accessible to Owner at all times C. Screenings removal and conveyance from operational channels shall not be disrupted except as allowed by contract
3	Constraints	A. All manual bar racks shall be replaced prior to any channel being removed from service. B. Channel downtime shall be minimized. All Work that can be completed without removal of channel(s) from service shall be completed prior to turnover of channel to Contractor, including but not limited to Electrical rough-in. C. No more than one channel shall be removed from service at a time, except as provided below. D. Two channels may be briefly removed from service when the screen influent division walls are replaced. This work shall only be permitted during dry weather when the meteorological forecast for the drainage area predicts no more than 10% hourly chance of precipitation for the planned duration of the work. The Contractor shall work three shifts until one channel is returned to service. Contractor shall be responsible for monitoring and transport of screenings from the bar racks to the dumpster during Contractor work shift(s).
4	Duration Limitations	See constraints above.

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SCHEDULE 01 14 00 – 3: CONSTRAINTS AND REQUIREMENTS – SCREENINGS CONVEYOR AND COMPACTOR		
1	General Work Summary	Phased, coordinated upgrade of the screenings conveyor and compactor system
2	Operational Requirements	A. Screenings conveyance and removal must be maintained at all times. B. Existing conveyor and compactor (including non-potable spray water supply) shall remain operational and accessible to Owner at all times until turned over to Contractor for demolition. C. Following commissioning, new conveyor and compactor shall remain operational and accessible to Owner at all times. D. Screenings removal and conveyance from operational channels shall not be disrupted except as allowed by contract. E. Screenings conveyor (existing or new) shall be interlocked with operational screens at all times.
3	Constraints	A. Conveyor downtime shall be minimized. All Work that can be completed without removal of conveyor from service shall be completed prior to turnover to Contractor, including but not limited to Electrical rough-in and all work in new Compactor Room. B. Temporary chutes / containers for operational screens shall be provided and maintained as needed during conveyor replacement. Contractor shall be responsible for monitoring and transport of screenings from the screen discharge to the dumpster during Contractor work shift(s). At the end of each shift, Contractor shall prepare temporary measures such that Owner staff can easily transport screenings to the disposal dumpster without requiring any additional Owner-furnished equipment or tools not otherwise used in operation of the permanent screenings facility. Contractor shall furnish to Owner any equipment or tools necessary to conduct such interim operation, and properly train/instruct Owner staff in its use as required.
4	Duration Limitations	See constraints above.

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SCHEDULE 01 14 00 – 4: CONSTRAINTS AND REQUIREMENTS – ELECTRICAL SYSTEM INCLUDING MCC-B		
1	General Work Summary	Phased, coordinated upgrade of electrical components to support equipment upgrades
2	Operational Requirements	A. Screenings conveyance and removal, raw sewage pumping, odor control, Administration and Operations Buildings must be maintained at all times. B. All in-service electrical components shall remain operational and accessible to Owner at all times. C. Screenings removal and conveyance from operational channels shall not be disrupted except as allowed by contract. D. Screenings conveyor (existing or new) shall be interlocked with operational screens at all times. E. Adequate facility lighting shall be maintained 24/7 at all times.
3	Constraints	A. All Work that can be completed without removal of equipment from service shall be completed prior to turnover to Contractor, including but not limited to Electrical rough-in. B. Temporary electrical components (i.e., lighting and GFI receptacles) shall be provided and maintained as needed during Contractor activities. C. MCC-B may only be shutdown one-half at any given time. Example: Preferred or Alternate source bus may be de-energized, but not both.
4	Duration Limitations	Maximum duration of any shutdown of a single MCC-B bus shall be 4 hours.

END OF SECTION

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SECTION 01 20 00

MEASUREMENT AND PAYMENT

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Items listed in this Section refer to and are the same pay items listed in the Bid Form and constitute all pay items for completing the Work.

2. Compensation for all services, items, materials, and equipment shall be included in prices stipulated for lump sum and unit price pay items listed in this Section and included in the Contract.

3. No direct or separate payment will be made for providing miscellaneous temporary or accessory works, bonds, insurance, or other requirements of the General Contract Conditions, Special Contract Conditions, General Requirements, and other requirements of the Contract Documents.

4. Each lump sum and unit bid price shall include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

B. Related Sections:

1. Payments to Contractor: Refer to General Contract Conditions, Special Contract Conditions, and Contract.

2. Changes to Contract Price: Refer to General Contract Conditions, Special Contract Conditions, and Section 01 26 00 – Contract Modification Procedures.

3. Schedule of Values: Refer to General Contract Conditions, Special Contract Conditions, and Section 01 29 73 – Schedule of Values.

1.02 ENGINEER'S ESTIMATE OF QUANTITIES

A. ENGINEER'S and OWNER's estimated quantities for unit price pay items, as listed in the Bid Form, are approximate only and are included solely for the purpose of comparison of Bids. Owner does not expressly or by implication agree that the nature of the materials encountered below the surface of the ground or the actual quantities of material encountered or required will correspond therewith and reserves the right to increase or decrease any quantity or to eliminate any quantity as Owner may deem necessary. Contractor will not be entitled to any adjustment in a unit bid price as a result of any change in an estimated quantity and agrees to accept the aforesaid unit bid prices as complete and total compensation for any additions caused by changes or alterations in the Work ordered by Owner.

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1.03 ADMINISTRATIVE REQUIREMENTS

A. Contractor shall include all additional Work items, services, goods, resources, and manpower necessary for installation of the Work to provide a completely functional system in accordance with the Contract Documents. Contractor shall include these costs associated with providing a completely functional system within the listed items on the Bid Form and as specified herein.

B. Bid Items:

1. **Bid Item 1: Lump Sum - Mobilization/Demobilization**

a. Description:

1) Under this Item, the Contractor shall provide work including mobilization and maintenance of forces and general equipment.

2) The Contractor shall also provide and update schedules; submit shop drawing information; attend meetings; implement a Safety, Health, and Emergency Response Plan; construct facilities and temporary controls; provide general quality control; provide bonding and insurance; provide and maintain erosion control; and complete miscellaneous work shown on the Drawings, but not included on other Bid Items.

b. Work Included Under This Item:

1) All work detailed within General Contract Conditions. All items not included under other Bid Items.

c. Associated Work Not Included Under This Item:

1) Work required under other Bid Items.

d. Method of Payment:

1) Payment shall be made based on the percentage of the overall project completed as reflected in each partial payment request up to 90% of the lump sum for Bid Item 1. Contractor shall be allowed to request up to 20% of the value of Bid Item 1 in the initial progress payment application. The final 10% of Bid Item 1 shall be withheld until the final payment for the project. The total value for Bid Item 1, Mobilization/ Demobilization, shall not exceed 10% of the total contract award.

2. **Bid Item 2: Lump Sum - Construction**

   a. Description:

      1) Under this Item, the Contractor shall furnish materials and construct the Screenings Improvements as called for in the Contract Documents.

      2) The Contractor shall also provide and update schedules; submit shop drawing information; attend meetings; implement a Safety, Health, and Emergency Response Plan; construct facilities and temporary controls; provide general quality control; provide bonding and insurance; provide and maintain erosion control; and complete miscellaneous work shown on the Drawings, but not included on other Bid Items.

   b. Work Included Under This Item:

      1) General Contract Conditions

      2) Special Contract Conditions

      3) Contract Drawings

      4) Technical Specifications

      5) Appendices

   c. Associated Work Not Included Under This Item:

      1) All other Bid Items.

   d. Method of Payment:

      1) Payment shall be made on a lump sum basis in accordance with the Contractor's pay item breakdown. Breakdown shall include as a minimum all items listed under Paragraph 1.03.B.2.b above.

3. **Bid Item 3: Stipulated Lump Sum - Miscellaneous Additional Work**

   a. Description:

      1) Under this Item, the Contractor shall furnish all labor, materials, and equipment necessary and perform all work necessary to repair unforeseen conditions, including hazardous materials, encountered during the course of the work or where directed by the Engineer.

   b. Work Included Under This Item:

1) Only miscellaneous additional work performed by the Contractor which has been authorized by the Engineer and Owner prior to its commencement.

c. Associated Work Not Included Under This Item:

1) All other Bid Items.

d. Method of Payment:

1) This bid item has a stipulated fixed price of $530,000. The total amount paid to the Contractor will be determined in accordance with the provisions of Article 84 of the General Contract Conditions, Pricing of Changes, and such payment will include only that overhead and profit that is applicable to the work performed under this Item. Only work authorized in writing will be paid for.

4. **Bid Item 4: Unit Price - Additional Type I Epoxy Cementitious Surface Seal Crack Repair**

1) Description:

a) Under this Item, the Contractor shall provide all labor, materials, equipment, and services required to perform Additional Type I Epoxy Cementitious Surface Seal Crack Repair as directed by the Engineer in accordance with Section 03 01 30 – Concrete Repairs.

2) Work Included Under This Item:

a) This Item also includes full compensation for providing all labor, materials, equipment, and services required for Confined Space Entry, CSE, support, Site Support, containment and removal of construction materials and debris, and Stream Protection, as required to perform Additional Type 1 Epoxy Cementitious Surface Seal Crack Repair.

3) Work Not Included Under This Item:

a) All other Bid Items.

4) Method of Payment:

a) Payment for this Item shall be based on a unit price per linear feet basis for all work required for Additional Type I Epoxy Cementitious Surface Seal Crack Repair.

5) Measurement and Limits:

a) The quantity for which payment will be made shall be the total number of linear feet of concrete cracks repaired as specified and as measured in place by the Engineer.

5. **Bid Item 5: Unit Price- Additional Type II Epoxy Injection Crack Repair**

1) Description:

a) Under this Item, the Contractor shall provide all labor, materials, equipment, and services required to perform Additional Type II Epoxy Injection Crack Repair as directed by the Engineer in accordance with Section 03 01 30 – Concrete Repairs.

2) Work Included Under This Item:

a) This Item also includes full compensation for providing all labor, materials, equipment, and services required for CSE support, Site Support, containment and removal of construction materials and debris, and Stream Protection in accordance with the Contract Documents, as required to perform Additional Type II Epoxy Injection Crack Repair.

3) Work Not Included Under This Item:

a) All Other Bid Items.

4) Method of Payment:

a) Payment for this Item shall be based on a unit price per linear feet basis for all work required for Additional Type II Epoxy Injection Crack Repair.

5) Measurement and Limits:

a) The quantity for which payment will be made shall be the total number of linear feet of concrete cracks repaired as specified and as measured in place by the Engineer.

6. **Bid Item 6: Unit Price – Additional Type III Waterproof Injection Grout Crack Repair**

1) Description:

a) Under this Item, the Contractor shall provide all labor, materials, equipment, and services required to perform Additional Type III

Waterproof Injection Grout Crack Repair as directed by the Engineer in accordance with Section 03 01 30 – Concrete Repairs.

2) Work Included Under This Item:

a) This Item also includes full compensation for providing all labor, materials, equipment, and services required for CSE support, Site Support, containment and removal of construction materials and debris, and Stream Protection in accordance with the Contract Documents, as required to perform Additional Type III Waterproof Injection Grout Crack Repair.

3) Work Not Included Under This Item:

a) All Other Bid Items.

4) Method of Payment:

a) Under this Item, the Contractor shall be paid on a per linear foot basis for all work required for Additional Type III Waterproof Injection Grout Crack Repair.

5) Measurement and Limits:

a) The quantity for which payment will be made shall be the total number of linear feet of concrete cracks repaired as specified and as measured in place by the Engineer.

7. **Bid Item 7: Unit Price - Additional Surface Spall Repair at a Depth of 4” or Less**

1) Description:

a) Under this Item, the Contractor shall provide all labor, materials, equipment, and services required to perform Additional Surface Spall Repair Material including incidental biofilm removal and disposal at the locations as directed by the Engineer in accordance with Section 03 01 30 – Concrete Repairs.

2) Work Included Under This Item:

a) This Item also includes labor, equipment, and materials for Water Management, in accordance with the Contract Documents, as required to perform Additional Surface Spall Repair at a Depth of 4” or Less.

3) Work Not Included Under This Item:

a) This Item shall not be used to pay for repairs due to damage caused by the Contractor's construction activities while performing other work.

4) Method of Payment:

a) Under This Item, the Contractor shall be paid on a per square foot basis for all work required for Additional Surface Spall Repair Material.

5) Measurement and Limits:

a) The quantity for which payment will be made shall be the total number of linear feet of concrete cracks repaired as specified and as measured in place by the Engineer.

8. **Bid Item 8: Unit Price - Additional Formed Spall Repair at a Depth Greater than 4"**

1) Description:

a) Under this Item, the Contractor shall providing all labor, materials, equipment, and services required to perform Additional Formed Spall Repair Material including incidental biofilm removal and disposal at the locations as directed by the Engineer in accordance with Section 03 01 30 – Concrete Repair.

2) Work Included Under This Item:

a) This Item also includes labor, equipment, and materials for Water Management, in accordance with the Contract Documents., as required to perform Additional Formed Spall Repair at a Depth Greater than 4".

3) Work Not Included Under This Item:

a) All Other Bid Items.

b) This Item shall not be used to pay for repairs due to damage caused by the Contractor's construction activities while performing other work.

4) Method of Payment:

a) Under this Item, the Contractor shall be paid on a per square foot basis for all work required for Additional Formed Spall Repair Material.

5) Measurement and Limits:

a) The quantity for which payment will be made shall be the total number of linear feet of spall repaired as specified and as measured in place by the Engineer.

9. **Bid Item 9: Unit Price - Additional Construction Joint Repair**

1) Description:

a) Under this Item, the Contractor shall provide all labor, materials, equipment, and services required to perform Additional Construction Joint Repair including incidental biofilm removal and disposal at the locations as directed by the Engineer in accordance with Section 03 01 30 – Concrete Repair.

2) Work Included Under This Item:

a) This Contract Item also includes labor, equipment, and materials for Water Management, in accordance with the Contract Documents, as required to perform Additional Construction Joint Repair.

3) Work Not Included Under This Item:

a) All Other Bid Items.

b) This Contract Item shall not be used to pay for repairs due to damage caused by the Contractor’s construction activities while performing other work.

4) Method of Payment:

a) Under this Item, the Contractor shall be paid on a per linear foot basis for all work required for Additional Construction Joint Repair.

5) Measurement and Limits:

a) The quantity for which payment will be made shall be the total number of linear feet of construction joint repaired as specified and as measured in place by the Engineer.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 01 25 00
SUBSTITUTION PROCEDURES

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Procedural requirements for product substitutions.

2. Procedural requirements for substitute construction methods or procedures, when construction methods or procedures are specified.

B. Requests for substitutions of equipment and material shall conform to the requirements of the General Contract Conditions and Special Contract Conditions.

C. Procedure for substitution requests and review including evaluation, reimbursement, acceptance, and determination shall be in accordance with General Contract Conditions and Special Contract Conditions.

1.02 REFERENCES

A. Definitions: The following words or terms are not defined but, when used in this Section, have the following meaning:

1. “Acceptable Manufacturers” considered for substitution include Suppliers of equipment and material of proven reliability, and as manufactured by reputable manufacturers having experience in the production of specified equipment and material. Equipment furnished shall be designed, constructed, and installed in accordance with the industry accepted practices and shall operate satisfactorily when installed in accordance with the Contract Documents.

2. “Products” includes materials, equipment, machinery, components, fixtures, systems, and other goods incorporated in the Work. Products do not include machinery and equipment used for preparing, fabricating, conveying, erecting, or installing the Work. Products include Owner-furnished goods incorporated in the Work where use of such goods is specifically required in the Contract Documents.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Contractor’s Responsibilities: In submitting request for substitution, Contractor represents that:

1. Contractor has investigated proposed substitution and determined that it is equivalent to item, product, method, or procedure specified, as applicable.

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2. Contractor will provide the same or better guarantees or warranties for proposed substitution as for the specified product, manufacturer, method, or procedure, as applicable.

3. Contractor waives all Claims for additional costs or extension of time related to proposed substitution that subsequently may become apparent.

4. Contractor shall submit a minimum of five (5) successful installations of the manufacturer's equipment of the same model, size, and type as specified in the Contract Documents.

B. Engineer's Review: A proposed substitution will not be accepted for review if:

1. Approval would require changes in design concept or a substantial revision of the Contract Documents.

2. Approval would delay completion of the Work or the work of other contractors.

3. Substitution request is indicated or implied on a Shop Drawing or other submittal, or on a request for interpretation or clarification, and is not accompanied by Contractor's formal request for substitution.

4. If the substitution is not clearly substantiated by performance criteria as providing an equivalent or superior performing installation.

C. If Engineer does not approve the proposed substitute, Contractor shall provide the specified product, manufacturer, method, or procedure, as applicable.

D. Approval of a substitution request will not relieve Contractor from requirement for submitting Shop Drawings as set forth in the Contract Documents.

E. Product Substitutions Procedure:

1. Requests for approval of substitute products or items will be considered for a period of 30 days after the Effective Date of the Agreement. After end of specified period, requests will be considered only in case of unavailability of a specified product or other conditions beyond Contractor's control.

2. Submit copies of request for substitution.

3. Submit separate request for each substitution.

4. In addition to requirements of the General Contract Conditions and information required on substitution request forms, include with request the following:

a. Product identification, including manufacturer's name and address.

b. Manufacturer's literature with product description, performance and test data, and reference standards with which product complies.

c. Samples, if appropriate.

d. Name and address of similar projects on which product was used, and date of installation.

e. Certified tests, where applicable, by an independent laboratory attesting the proposed substitution is equal.

f. Cost information for the proposed substitution and the specified products.

g. Lead time information for the proposed substitution and specified products.

h. All other submittal requirements indicated in the individual Specification Sections associated with the specified equipment and material.

F. Construction Methods Substitutions Procedures:

1. Where construction methods or procedures are specified, for a period of 30 days after the Effective Date of the Agreement, Engineer will consider Contractor's written requests for substitute construction methods or procedures specified.

2. Submit copies of request for substitution.

3. Submit separate request for each substitution.

4. In addition to requirements of the General Contract Conditions and information required on substitution request forms, include with request the following:

a. Detailed description of proposed method or procedure.

b. Itemized comparison of the proposed substitution with the specified method or procedure.

c. Drawings illustrating method or procedure.

d. Other data required by Engineer to establish that proposed substitution is equivalent to specified method or procedure.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Section Includes:

1. General Contract Conditions and Special Contract Conditions provision expansion, including the following:

a. Requests for interpretation.

b. Field Orders

c. Work Change Directives

d. Proposal requests

e. Change Proposals

f. Change Orders

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submit Contract modification documents to Engineer's contact person and address in the Contract Documents.

B. Retain at Contractor's office and at the Site complete copy of each Contract modification document and related documents, and Engineer's response.

1.03 REQUEST FOR INTERPRETATION

A. General:

1. Submit written or electronic requests for interpretation to Engineer. Contractor and Owner may submit requests for interpretation.

2. Submit request for interpretation to obtain clarification or interpretation of the Contract Documents. Report conflicts, errors, ambiguities, and discrepancies in the Contract Documents using requests for interpretation.

3. Do not submit request for interpretation when other form of communication is appropriate, such as submittals, requests for substitutions or "or equals", notices, ordinary correspondence, or other form of communication. Improperly prepared or inappropriate requests for interpretation will be returned without response or action.

B. Procedure:

1. Submit one original (hard copy or electronic) of each request for interpretation. Submit each request for interpretation with separate letter of transmittal if hard copies are submitted.

2. Engineer will provide timely review of requests for interpretation. Allow sufficient time for review and response.

3. Engineer will maintain log of requests for interpretation. Copy of log will be provided upon request.

4. Engineer will provide written response to each request for interpretation. One copy of Engineer's response will be distributed to:

a. Contractor

b. Owner

c. Engineer

d. Resident Project Representative (RPR)

C. If Engineer requests additional information to make an interpretation, provide information requested within ten (10) days, unless Engineer allows additional time, via correspondence referring to request for interpretation number.

D. If Contractor or Owner believes that a change in the Contract Price or Contract Times or other change to the Contract is required, notify Engineer in writing before proceeding with the Work associated with the request for interpretation.

E. Submit each request for interpretation on a form acceptable to Engineer.

1. Number each request for interpretation as follows: Numbering system shall be the Contract number and designation followed by a hyphen and three-digit sequential number.

2. In space provided on form, describe the interpretation requested. Provide additional sheets as necessary. Include text and sketches as required in sufficient detail for engineer's response.

3. When applicable, request for interpretation shall include Contractor's recommended resolution.

1.04 FIELD ORDERS

A. General:

1. Field Orders, when required, will be initiated and issued by Engineer.

2. Field Orders authorize minor variations in the Work but do not change the Contract Price or Contract Times.

3. Field Orders will be in the form of Engineers Joint Contract Documents Committee (EJCDC) document C-942, “Field Order” or other Engineer’s accepted form.

4. Engineer will maintain a log of Field Orders issued.

B. Procedure:

1. Electronic copies of Field Orders will be maintained, stored, and distributed by electronic construction document management system.

2. If Contractor or Owner believes that a change in the Contract Price or the Contract Times or other change to the Contract is required, immediately notify Engineer in writing before proceeding with the Work associated with the Field Order.

3. If the Field Order is unclear, submit request for interpretation.

1.05 WORK CHANGE DIRECTIVE

A. General:

1. Work Change Directives, when required, order additions, deletions, or revisions to the Work.

2. Work Change Directives do not change the Contract Price or Contract Times but are evidence that the parties to the Contract expect that the change ordered or documented by the Work Change Directive will be incorporated in subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

3. Work Change Directives will be in the form of EJCDC document C-940, “Work Change Directive” or other Engineer’s accepted form.

B. Procedure:

1. Three originals of Work Change Directive signed by Owner and Engineer will be furnished to Contractor, who shall promptly sign each original Work Change Directive and, within five days of receipt, return all originals to Engineer.

2. Original, signed Work Change Directives will be distributed as follows:

a. Contractor: One original

b. Owner: One original

c. Engineer: One original

3. One hard copy of each Work Change Directive will be distributed to: Resident Project Representative (RPR).

4. When required by Engineer, document for the Work performed under each separate Work Change Directive, for each day, the number and type of workers employed and hours worked; equipment used including manufacturer, model, and year of equipment, and number of hours; materials used, receipts for and descriptions of materials and equipment incorporated into the Work, invoices and labor and equipment breakdowns for Subcontractors and Suppliers, and other information required by Owner or Engineer, in a format acceptable to Engineer. Submit this documentation to Engineer as a Change Proposal.

1.06 PROPOSAL REQUESTS

A. General:

1. Proposal requests may be initiated by Engineer or Owner.

2. Proposal requests are for requesting the effect on the Contract Price and the Contract Times and other information relative to contemplated changes in the Work. Proposal requests do not authorize changes or variations in the Work, and do not change the Contract Price or Contract Times or terms of the Contract.

3. Proposal requests will be furnished using the proposal request form included with this Section.

B. Procedure.

1. One copy of each signed proposal request will be furnished to Contractor with one copy each to:

a. Owner

b. Engineer

c. Resident Project Representative (RPR)

2. Submit request for interpretation to clarify conflicts, errors, ambiguities, and discrepancies in proposal request.

3. Upon receipt of proposal request, Contractor shall prepare and submit a Change Proposal, in accordance with this Section, for the proposed Work described in the proposal request.

1.07 CHANGE PROPOSALS

A. General.

1. Submit written Change Proposal to Engineer in response to each proposal request, and when Contractor believes a change in the Contract Price or Contract Times or other change to the terms of the Contract is required.

B. Procedure.

1. Submit to Engineer one original and one copy of each Change Proposal with accompanying documentation, and simultaneously submit two copies to Owner. Submit each Change Proposal with separate letter of transmittal.

2. Engineer will review Change Proposal and either request additional information from Contractor or provide to Owner recommendation regarding approval of the Change Proposal.

3. When Engineer requests additional information to render a decision, submit required information within five days of receipt of Engineer's request, unless Engineer allows more time. Submit the required information via correspondence that refers to Change Proposal number.

4. Upon completing review, one copy of Engineer's written response, if any, will be distributed to:

a. Contractor

b. Owner

c. Engineer

d. Resident Project Representative (RPR)

5. If Change Proposal is recommended for approval by Engineer and approved by Owner, a Change Order will be issued.

6. If parties do not agree on terms for the change, Owner or Contractor may file a Claim against the other, in accordance with the General Contract Conditions and the Special Contract Conditions.

C. Each Change Proposal shall be submitted on a Change Proposal form acceptable to Engineer.

1. Number each Change Proposal as follows: Numbering system shall be the Contract number and designation followed by a hyphen and three-digit sequential

number. Example: First Change Proposal for the general contract for project named “Contract 23” would be, “Proposal No. 23-001”.

2. In space provided on form:

   a. Describe scope of each proposed change. Include text and sketches on additional sheets as required to provide detail sufficient for Engineer’s review and response. If a change item is submitted in response to proposal request, write in as scope, “In accordance with Change Proposal Request No.” followed by the proposal request number. Provide written clarifications, if any, to scope of change.

   b. Provide justification for each proposed change. If change is in response to proposal request, write in as justification, “In accordance with Change Proposal Request No.” followed by the proposal request number.

   c. List the total change in the Contract Price and Contract Times for each proposed change.

3. Unless otherwise directed by Engineer, attach to the Change Proposal detailed breakdowns of pricing (Cost of the Work and Contractor’s fee) including:

   a. List of Work tasks to accomplish the change.

   b. For each task, labor cost breakdown including labor classification, total hours per labor classification, and hourly cost rate for each labor classification.

   c. Construction equipment and machinery to be used, including manufacturer, model, and year of manufacture, and number of hours for each.

   d. Detailed breakdown of materials and equipment to be incorporated into the Work, including quantities, unit costs, and total cost, with Supplier’s written quotations.

   e. Breakdowns of the Cost of the Work and fee for Subcontractors, including labor, construction equipment and machinery, and materials and equipment incorporated into the Work, other costs, and Subcontractor fees.

   f. Breakdown of other costs eligible, in accordance with the General Contract Conditions and the Special Contract Conditions.

   g. Other information required by Engineer.

   h. Contractor’s fees applied to eligible Contractor costs and eligible Subcontractor costs.

1.08 CHANGE ORDERS

A. General:

1. Change Orders will be recommended by Engineer and signed by Owner, and Contractor, to authorize additions, deletions, or revisions to the Work, or changes to the Contract Price or Contract Times.

2. Change Orders will be in the form of EJCDC document C-941, “Change Order” or other Engineer’s accepted form.

B. Procedure.

1. Five originals of each Change Order will be furnished to Contractor, who shall sign each original Change Order and return all originals to Engineer within five days of receipt.

2. Engineer will sign each original Change Order and forward them to Owner.

3. Owner will sign each original Change Order and forward to the funding agency.

4. After approval and signature of all parties, three executed original copies will be returned to Engineer. Engineer will distribute as follows:

a. Contractor: One original

b. Owner: One original

c. Engineer: One original

5. One copy of each Change Order will be distributed to:

a. Resident Project Representative (RPR)

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 SCHEDULE

A. 2013 EJCDC Form C-942, Field Order

B. 2013 EJCDC Form C-940, Work Change Directive

C. 2013 EJCDC Form C-941, Change Order

END OF SECTION

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

Field Order No. _____

Date of Issuance:	Effective Date:
Owner:	Owner's Contract No.:
Contractor:	Contractor's Project No.:
Engineer:	Engineer's Project No.:
Project:	Contract Name:

Contractor is hereby directed to promptly execute this Field Order, issued in accordance with the General Contract Condition, for minor changes in the Work without changes in Contract Price or Contract Times. If Contractor considers that a change in Contract Price or Contract Times is required, submit a Change Proposal before proceeding with this Work.

Reference: _____ _____
Specification(s) Drawing(s) / Detail(s)

Description:

Attachments:

ISSUED:	RECEIVED:
By: _____	By: _____
Engineer (Authorized Signature)	Contractor (Authorized Signature)
Title: _____	Title: _____
Date: _____	Date: _____

Copy to: Owner

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

Work Change Directive No. _____

Date of Issuance:	Effective Date:
Owner:	Owner's Contract No.:
Contractor:	Contractor's Project No.:
Engineer:	Engineer's Project No.:
Project:	Contract Name:

Contractor is directed to proceed promptly with the following change(s):
Description:

Attachments: [List documents supporting change]

Purpose for Work Change Directive:
Directive to proceed promptly with the Work described herein, prior to agreeing to changes on Contract Price and Contract Time, is issued due to: [check one or both of the following]

☐ Non-agreement on pricing of proposed change.

☐ Necessity to proceed for schedule or other Project reasons.

Estimated Change in Contract Price and Contract Times (non-binding, preliminary):

Contract Price $ _____ [increase] [decrease].

Contract Time ____ days [increase] [decrease].

Basis of estimated change in Contract Price:

☐ Lump Sum ☐ Unit Price

☐ Cost of the Work ☐ Other

RECOMMENDED:	AUTHORIZED BY:	RECEIVED:
By: _____	By: _____	By: _____
Engineer (Authorized Signature)	Owner (Authorized Signature)	Contractor (Authorized Signature)
Title: _____	Title: _____	Title: _____
Date: _____	Date: _____	Date: _____

Approved by Funding Agency (if applicable)

By: _____ Date: _____

Title: _____

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

Change Order No. _____

Date of Issuance:	Effective Date:
Owner:	Owner's Contract No.:
Contractor:	Contractor's Project No.:
Engineer:	Engineer's Project No.:
Project:	Contract Name:

The Contract is modified as follows upon execution of this Change Order:

Description:

Attachments: [List documents supporting change]

CHANGE IN CONTRACT PRICE	CHANGE IN CONTRACT TIMES
Original Contract Price: $	[note changes in Milestones if applicable] Original Contract Times: Substantial Completion: Ready for Final Payment: days or dates
[Increase] [Decrease] from previously approved Change Orders No. to No. : $	[Increase] [Decrease] from previously approved Change Orders No. to No. : Substantial Completion: Ready for Final Payment: days
Contract Price prior to this Change Order: $	Contract Times prior to this Change Order: Substantial Completion: Ready for Final Payment: days or dates
[Increase] [Decrease] of this Change Order: $	[Increase] [Decrease] of this Change Order: Substantial Completion: Ready for Final Payment: days or dates
Contract Price incorporating this Change Order: $	Contract Times with all approved Change Orders: Substantial Completion: Ready for Final Payment: days or dates

RECOMMENDED:	ACCEPTED:	ACCEPTED:
By: _____	By: _____	By: _____
Engineer (if required)	Owner (Authorized Signature)	Contractor (Authorized Signature)
Title: _____	Title: _____	Title: _____
Date: _____	Date: _____	Date: _____

Approved Funding Agency (if required)

By: _____ Date: _____

Title: _____

SECTION 01 29 73
SCHEDULE OF VALUES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. General requirements for preliminary and final Schedule of Values.

2. Schedule of Values and the Progress Schedule updates specified in Section 01 32 00 – Construction Progress Schedule, shall be basis for preparing each Application for Payment. Schedule of Values may be used as a basis for negotiating price of changes, if any, in the Work.

1.02 ADMINISTRATIVE REQUIREMENTS

A. General Requirements:

1. Schedule of Values shall include breakdown of costs for materials and equipment, installation, and other costs used in preparing the Bid by Contractor and each Subcontractor. List purchase and delivery costs for materials and equipment for which Contractor may apply for payment as stored materials.

2. Include separate amounts for each Specification Section in the Contract Documents by structure, building, and work area.

3. Identify each line item with number corresponding to the associated Specification Section number. List sub-items of major products or systems, as appropriate or when requested by Engineer.

4. Include in Schedule of Values unit price payment items with their associated quantity. Provide in the Schedule of Values detailed breakdown of unit prices when required by Engineer.

5. Include in Schedule of Values itemized list of Work for each major part of the Contract, for each payment item specified in Section 01 20 00 – Measurement and Payment.

6. Sum of individual values shown on the Schedule of Values shall equal the total of associated payment item. Sum of payment item totals in the Schedule of Values shall equal the Contract Price.

B. Specific Requirements:

1. Include in each line item a directly proportional amount of Contractor’s overhead and profit. Do not include overhead and profit as separate item(s).

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2. Include separate line item for each allowance, and for each unit price item

3. Include line item for bonds and insurance in amount not exceeding two percent of the Contract Price. This may be applied for in the first Application for Payment.

4. Include items for the General Contract Conditions, permits (when applicable), construction Progress Schedule, and other items required by Engineer. Include such items in Applications for Payment on schedule accepted by Engineer

5. Line items for Site maintenance such as dust control, snow removal, compliance with storm water pollution prevention plans and permits, spill prevention control and countermeasures plans, and for construction photographic documentation; temporary utilities and temporary facilities, field offices, temporary controls, field engineering, and similar Work shall be included in the Schedule of Values and proportioned in Applications for Payment throughout duration of the Work.

6. Include separate line items under each appropriate payment item for mobilization and demobilization. Document for Engineer the activities included in mobilization and demobilization line items.

    a. Mobilization will be limited to two percent of the Contract Price, and will be paid in two payments, each of 50 percent of total amount for mobilization.

    b. Demobilization shall be at least one percent of the Contract Price and shall be included with the Application for Payment following Substantial Completion, or other schedule accepted by Engineer.

7. Costs for submittals, operations and maintenance manuals, field testing, and training of operations and maintenance personnel shall be as follows, unless otherwise accepted by Engineer:

    a. Up to three percent of total cost of each item (including overhead and profit), including materials and equipment, and installation, may be apportioned to testing and included in the Application for Payment following Engineer's acceptance of the associated written Site testing report(s).

C. Preliminary Schedule of Values: Submit preliminary Schedule of Values to Engineer for initial review. Contractor shall incorporate Engineer's comments into the Schedule of Values and resubmit to Engineer. Engineer may require corrections and re-submittals until Schedule of Values is acceptable.

D. Time Frame for Submittals:

1. Submit preliminary Schedule of Values within ten days of date that the Contract Times commence running in accordance with the Notice to Proceed.

2. Submittal of the Schedule of Values shall be in accordance with the General Contract Conditions and these Specifications. Engineer will not accept Applications for Payment without an acceptable Schedule of Values.

3. When required by Engineer, promptly submit updated Schedule of Values to include cost breakdowns for changes in the Contract Price.

1.03 SUBMITTALS

A. Submit the following:

1. Preliminary Schedule of Values.

   a. Printed Copies: Seven copies.

   b. Electronic Copies: One copy.

2. Schedule of Values.

   a. Printed Copies: Seven copies.

   b. Electronic Copies: One copy.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 01 29 76

PROGRESS PAYMENT PROCEDURES

PART 1 – GENERAL

1.01 SUMMARY

A. Administrative and procedural requirements for progress payment to the Contractor by the Owner.

B. Related Sections:

1. Section 01 77 19 – Closeout Requirements.

1.02 ADMINISTRATIVE REQUIREMENTS

A. General: Contractor's request for payment shall be in accordance with the Agreement, General Contract Conditions and Special Contract Conditions, and the Specifications.

B. Procedure:

1. Review with Resident Project Representative (RPR) quantities and the Work proposed for inclusion in each progress payment. Application for Payment shall cover only the Work and quantities recommended by the RPR.

2. Submit to Engineer five originals of each complete Application for Payment and other documents to accompany the Application for Payment.

3. Engineer will act on request for payment in accordance with the General Contract Conditions and Special Contract Conditions.

C. Requirements:

1. Completed Application for Payment form, including summary/signature page, progress estimate sheets, and stored materials summary. Progress estimate sheets shall have the same level of detail as the Schedule of Values.

2. For materials and equipment not incorporated in the Work but suitably stored, submit documentation in accordance with the General Contract Conditions and Special Contract Conditions. Legibly indicate on invoice or bill of sale the specific materials or equipment included in the payment request and corresponding bid/payment item number for each.

3. Contractor's Affidavit is required for payment application and requests beginning with the second application for payment.

4. For payment requests that include payment for Work under an allowance, submit documentation acceptable to Owner of the authorization of allowance Work.

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5. For payment requests (other than request for final payment) that include reduction or payment of retainage in an amount greater than that required in the Contract Documents, submit on form acceptable to Owner consent of surety to partial release or reduction of retainage.

D. Requirements for request for final payment are in the General Contract Conditions, as modified by the Special Contract Conditions, and Section 01 77 19 – Closeout Requirements.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 31 19

PROJECT MEETINGS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Pre-Construction Meeting:

a. Purpose of conference is to designate responsible personnel, establish working relationships, discuss preliminary schedules submitted by Contractor, and review administrative and procedural requirements for the Project. Matters requiring coordination will be discussed and procedures for handling such matters will be established.

b. Date, Time and Location: Conference will be held after execution of the Contract and before Work starts at the Site. Engineer will establish the date, time, and location of conference and notify the interested and involved parties.

2. Progress Meetings:

a. Progress meetings will be held throughout the Project. Contractor shall attend each progress meeting prepared to discuss in detail all items on the agenda.

b. Engineer will preside at progress meetings and will prepare and distribute minutes of progress meetings to all meeting participants and others as requested.

c. Date, Time and Location:

1) Regular Meetings: Every month on a day and time agreeable to Owner, Engineer, and Contractor.

2) Location mutually agreed upon by Owner, Contractor, and Engineer.

d. Additional meetings may be conducted as progress of Work requires at a mutually agreed date, time and location.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Pre-Construction Meeting:

1. Contractor shall provide pre-construction meeting submittals with sufficient number of copies for each attendee:

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2. Required Attendees:

    a. Contractor

        1) Project manager.

        2) Site superintendent.

        3) Safety representative.

        4) Major Subcontractors.

    b. Owner.

    c. Engineer.

    d. Resident Project Representative (RPR).

3. Contractor shall prepare and submit a health and safety plan, including confined space entry plan, as specified in this Section prior to the pre-construction meeting.

4. Agenda, minimum:

    a. Procedural requirements:

        1) Designation of responsible personnel

        2) Use of Site and Owner’s requirements, including general regards for community relations

        3) Delivery of materials and equipment to the Site

        4) Safety and first aid procedures

        5) Confined space entry plan

        6) Security procedures

        7) Housekeeping procedures

    b. Administrative requirements:

        1) Distribution of Contract Documents.

        2) Shop Drawing submittal procedures.

        3) Maintaining record documents at the Site.

        4) Contract modification procedures

5) Processing of Payment Application

c. Site mobilization requirements:

1) Working hours, overtime, and holidays.

2) Field offices, trailers, and staging areas.

3) Temporary facilities and utilities, including usage and coordination.

4) Temporary controls, such as sediment and erosion control, noise, dust, storm water, and other measures.

5) Access to Site, access roads, and parking for construction vehicles.

6) Protection of traffic and existing property, including site barriers and temporary fencing.

7) Security

8) Storage of materials and equipment.

9) Reference points and benchmarks, surveys and layouts.

10) Site maintenance during the project, including cleaning and removal of trash and debris.

11) Site restoration.

d. Schedules

1) Preliminary construction schedule

2) Critical work sequencing

3) Preliminary Shop Drawing submittal schedule

4) Preliminary Schedule of Values

B. Progress Meetings:

1. Progress meetings frequency shall be conducted as specified in this Section, unless modified and agreed upon by Owner, Contractor, and Engineer. Additional meetings may be conducted as progress of Work requires.

2. Contractor shall provide submittals specified in this Section prior to each progress meeting.

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3. Attendance:

    a. Contractor, including project manager, site superintendent, safety representative, and representatives of Subcontractors and Suppliers as required.

    b. Engineer, including project manager (or designated representative), Resident Project Representative (if any), others as required by Engineer.

    c. Owner, including Owner's Site Representative (if any).

    d. Subcontractors, only with Engineer's approval or request, as required in the agenda.

4. Agenda, minimum:

    a. Review, comment, and amendment (if required) of minutes of previous progress meeting.

    b. Review of progress since the previous progress meeting.

    c. Planned progress through next 30 – 60 days.

    d. Review of Progress Schedule

        1) Contract Times, including Milestones (if any)

        2) Critical path.

        3) Schedules for fabrication and delivery of materials and equipment.

        4) Corrective measures, if required.

    e. Submittals:

        1) Review of status of critical submittals.

        2) Review revisions to schedule of submittals.

    f. Contract Modifications:

        1) Requests for interpretation

        2) Clarification notices

        3) Field Orders

        4) Proposal requests

5) Change Proposals

6) Work Change Directives.

7) Change Orders.

8) Claims.

g. Applications for progress payments.

h. Problems, conflicts, and observations.

i. Quality standards, testing, and inspections.

j. Coordination between parties.

k. Site management issues, including access, security, maintenance and protection of traffic, maintenance, cleaning, and other Site issues.

l. Safety.

m. Permits.

n. Record documents status.

o. Punch list status, as applicable.

p. Other business.

1.03 SUBMITTALS

A. Pre-Construction Meeting Submittals:

1. Prior to the conference, submit the following preliminary schedules in accordance with the General Conditions:

1) Progress schedule

2) Schedule of submittals

3) Schedule of values

2. Contractor’s safety and first aid procedures.

3. Confined space entry plan.

4. List of emergency contact information

B. Progress Meeting Submittals:

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1. List of Work accomplished since the previous progress meeting.

2. Up-to-date Progress Schedule.

3. Up-to-date Schedule of Submittals.

4. Detailed “look-ahead” schedule of Work planned through the next progress meeting, with specific starting and ending dates for each activity, including shutdowns, deliveries of important materials and equipment, Milestones (if any), and important activities affecting the Owner, Project, and Site.

5. When applicable, list of upcoming, planned time off (with dates) for personnel with significant roles on the Project, and the designated contact person in their absence.

1.04 EMERGENCY CONTACT INFORMATION

A. Contractor shall provide list of emergency contact information for 24-hour use throughout the Project. Emergency contact information shall be updated and kept current throughout the Project. If personnel or contact information change, provide updated emergency contact information list at the next progress meeting.

B. Contractor’s list of emergency contact information shall include:

1. Contractor’s project manager’s office, field office, cellular, and home telephone numbers.

2. Contractor’s Site superintendent’s office, field office, cellular, and home telephone numbers.

3. Contractor’s foreman’s field office, cellular (if available), and home telephone numbers.

4. Major Subcontractors’ and Suppliers’ office, cellular, and home telephone numbers of project manager and foreman (when applicable).

C. Additional Emergency Contact Information:

1. Owner’s Project Manager: office, cellular, and home telephone numbers.

2. Owner’s central 24-hour emergency telephone number.

3. Engineer’s project engineer’s office, cellular, and home telephone numbers.

4. Resident Project Representative’s office, field office, cellular, and home telephone numbers.

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5. Emergency telephone numbers, including: “Emergency: Dial 911”, and seven-digit telephone numbers for the hospital, ambulance, police, and fire department nearest to the Site. Provide names of each of these institutions.

6. Other involved entities as applicable.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 01 32 00
CONSTRUCTION PROGRESS SCHEDULE

PART 1 – GENERAL

1.01 SUMMARY

A. Contractor shall prepare and submit Progress Schedules and related documents in accordance with the General Contract Conditions, as may be modified by the Special Contract Conditions, and this Section, unless otherwise accepted by Engineer.

1. Maintain and update Progress Schedules and related documents.

2. Progress Schedule shall be a Critical Path Method (CPM) Progress Schedule.

B. Engineer's acceptance of the Progress Schedule or related documents, and comments or opinions concerning activities in the Progress Schedule and related documents shall not control independent judgment of Contractor concerning means, methods, techniques, sequences and procedures of construction, unless the associated means, method, technique, sequence, or procedure is directed by the Contract Documents. Contractor is solely responsible for complying with the Contract Times.

1.02 REFERENCES

A. Definitions:

1. Activity: An element of the construction work that has the following specific characteristics: consumes time, consumes resources, has a definable start and finish, is assignable, and is measurable.

2. Constraint: An imposed date on the Progress Schedule or an imposed tie between Activities. The Contract Times are Constraints.

3. CPM Progress Schedule: Computerized Progress Schedule in Critical Path Method (CPM) format which accounts for the entire Work, defines the interrelationships between elements of the Work, reflects the uncompleted Work, and indicates the sequence with which the Work has been completed, indicates the sequence in which uncompleted Work will be completed, and indicates the duration of each Activity.

4. Critical Path: The continuous chain of Activities with the longest duration for completion within the Contract Times.

5. Early Start: The earliest possible date an Activity can start according to the assigned relationships among Activities.

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6. Early Finish: The earliest date an Activity can finish according to the assigned relationships among the Activities.

7. Late Finish: The latest date an Activity can finish without extending the Contract Times.

8. Late Start: The latest date an Activity can start without extending the Contract Times.

9. Float: The time difference between the calculated duration of the Activity chain and the Critical Path.

10. Total Float: The total number of days that an Activity (or chain of Activities) can be delayed without affecting the Contract Times.

11. Network Diagram: A time-scaled logic diagram depicting the durations and relationships of the Activities.

12. Work Areas, Area, or System: A logical breakdown of the Project elements or a group of Activities which, when collectively assembled, are readily identifiable on the Project (for example, yard piping, a structure or building, a treatment process, or other logical grouping).

1.03 ADMINISTRATIVE REQUIREMENTS

A. Initial Progress Schedule:

1. Type and Organization of Progress Schedules:

   a. Prepare one Progress Schedule covering the entire Project using Primavera Project Planner P6 (version 16 or newer), or Microsoft Project scheduling software as approved by the Engineer.

   b. Schedule submittals shall include the electronic native file format (i.e., scheduling software file), and a PDF file of the schedule’s logic diagram.

   c. Time Scale: Indicate first date of each work week.

   d. Activity Designations: Indicate concise description of the Work represented by the activity and related Specification Section number. The Work related to each activity shall be limited to one work trade and one construction area.

2. Submitted PDF files shall be in a Gantt Chart Format and shall show the following:

   a. Activity identification number.

   b. Activity description.

c. Activity duration (in workdays).

d. Activity percent complete

e. Start, Early Start, Late Start, Finish, Early Finish, and Late Finish Dates

f. Total Float for each Activity.

g. Critical Path denoted.

3. Organization:

a. Group shop drawings, samples and other submittals into a separate sub-schedule that is part of the Progress Schedule.

b. Group deliveries of materials and equipment into a separate sub-schedule that is part of the Progress Schedule.

c. Group construction into Work Area sub-schedules (that are part of the Progress Schedule) by Activity.

d. Clearly indicate the Critical Path on the Progress Schedule.

e. Organize each Work Area sub-schedule by Specification Section number.

4. Preliminary Progress Schedule:

a. Contractor shall submit to Engineer the preliminary Progress Schedule with associated Network Diagrams within 30 days after the Contract Times commence running.

b. Submit 5 copies of preliminary Progress Schedule and associated reports and schedule-related documents to accompany the preliminary Progress Schedule, in accordance with the Submittals Article of this Section. Submit in accordance with Section 01 33 00 – Submittal Procedures.

5. Initial Acceptance of Progress Schedule:

a. At least 10 days before submission of the first Application for Payment, Contractor shall schedule a conference at the Site for review of the preliminary Progress Schedule.

1) Attendees shall include Contractor, Engineer, Owner and others as required.

2) Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the Progress Schedule and associated Network Diagram.

3) Owner reserves the right to not make progress payment to Contractor until acceptable Progress Schedule, Network Diagram, and other reports and schedule-related documents required are submitted to Engineer.

b. Submit 5 copies each of acceptable Progress Schedule with Network Diagram, reports, and other schedule-related documents required to accompany the initial acceptable Progress Schedule, in accordance with the Submittals Article of this Section.

c. Initially-accepted Progress Schedule shall be identified as the baseline Progress Schedule. The Baseline Progress Schedule shall not be revised without Owner and Engineer approval

B. Progress Schedule Updates:

1. Project Schedule Updates shall be prepared on a monthly basis throughout the entire Contract Time and until Project Final Completion. The Engineer will not recommend progress payments by the Owner until a complete Project Schedule Update (including Schedule Narrative Report) is received, reviewed, and accepted by the Engineer.

2. The update to the Progress Schedule shall be based on retained logic. Progress override logic is not allowed.

3. Required scheduling software, and schedule organization, format, and content for updated Progress Schedules are identical to that required in this Section for initial Progress Schedules.

4. Submit to Engineer 5 hard copies of the updated Progress Schedule, Network Diagram, narrative report, and other schedule-related reports and documents required.

5. Submit updated Network Diagrams when revisions are proposed to the logic. Indicate in the narrative report delays that have occurred since the previous updated Progress Schedule. Engineer will not recommend payment by Owner of progress payments until updated Progress Schedule is received, reviewed, and accepted by Engineer. Payment for out-of-sequence Work is not allowed.

6. For all Project Schedule Updates, the percent complete reported for individual Activities shall be based on Work accepted and paid for the by Owner in monthly pay applications. Failure to comply with this requirement shall be result in rejection of the submitted update. Rejection of the Project Schedule Update will in turn result in the Engineer not recommending progress payments by the Owner.

7. Monthly Progress Schedule Updates shall be accompanied by a Schedule Narrative Report. The report shall:

a. Describe Work completed within the preceding month.

b. Describe Work planned for the following month (including a look-ahead schedule).

c. Identify proposed changes or revisions to the Baseline Progress Schedule.

d. Identify all Work performed out of sequence.

e. Identify problem areas.

f. Identify current or anticipated conditions which may delay the Work.

g. Explain any corrective actions the Contractor plans to take or propose.

1.04 NETWORK DIAGRAMS (PERT CHARTS)

A. General:

1. Contractor shall prepare and submit Network Diagrams, as generated using the scheduling software on paper of the size indicated for Progress Schedules in this Section.

2. Group Network Diagrams by Area and show the order and interdependence of Activities and sequence and quantities in which the Work will be accomplished.

3. Do not use match lines on Network Diagrams. Depict interrelationships to or from Activities outside the Area shown using an Activity symbol with Activity number and description.

4. In preparing Network Diagrams, comply with the basic concept of precedence diagramming method (PDM) network scheduling to show how start of a given Activity depends on completion of preceding Activities, and how the Activity's completion may affect the start of subsequent Activities.

5. Level of schedule detail shall define the day-to-day Activities of the Work.

B. Content:

1. Clearly indicate the Critical Path and distinguish the Critical Path from other paths on the network.

2. Organize Network Diagrams by grouping into major Work Areas, including one for procurement of materials and equipment, and by specific Activity within each Area.

3. Logic diagrams shall include the following:

a. Activity number.

b. Activity description.

c. Activity duration (in work days).

d. Critical Path denoted.

e. Float for each Activity.

f. Activity or System designation.

g. Coded Area designation.

h. Responsibility code (e.g., each prime contractor and their respective Subcontractors, trade, operation, Suppliers, or other entity responsible for accomplishing an Activity).

i. Shift number (if more than one shift per day is to be employed).

C. Revisions:

1. When conditions develop that require revisions to logic or durations of the Network Diagram associated with the initially accepted Progress Schedule (i.e., baseline Progress Schedule), identify updates to the Network Diagram in the same manner required in this Section for Progress Schedule updates.

2. Revision of the logic or durations from the baseline Progress Schedule initially accepted by Engineer shall be submitted to Engineer for acceptance.

3. Incorporate into the Progress Schedule revisions to logic or duration accepted by Engineer and include in monthly narrative report both a description of revisions and listing of Activities affected by revisions.

4. Changes resulting from Change Orders and other additions or deletions, shall be fully incorporated into the Progress Schedule and Network Diagram on the first update after the associated Change Order is approved by Owner, including adjustments to the Contract Price.

1.05 PROJECT SCHEDULE DEVELOPMENT

A. The schedule shall cover the entire Contact Time, and the Work shall be scheduled to complete the Project within the Contract Time.

B. The Schedule’s Late Finish Date shall equal the Contract Completion Date.

C. All activities except for the NTP and Final Completion shall have a predecessor and a successor. No open-ended activities will be permitted. Note that NTP shall have a successor or successors and Final Completion shall have a predecessor or predecessors.

D. Proposed durations assigned to each activity shall be the Contractor's best estimate of time required to complete the activity, considering the scope and resources planned for the activity.

E. The durations of activities shall be expressed in whole working days, with a maximum duration of 20 workdays each, unless otherwise approved or directed by the Engineer or the Owner. The duration of non-construction activities including mobilization, shop drawings and sample submittals, fabrication of materials and equipment, and delivery of materials and equipment may exceed this limitation.

F. The Schedule shall incorporate in detail all elements of the Work contained within the Contract Documents. Specific elements of the Work to incorporate into the schedule include but are not limited to the following:

1. Notice to Proceed.
2. Mobilization and demobilization.
3. Submittals including O&M Manuals. Note that durations for Engineer review time shall be 30 working days unless specified elsewhere in these Contract Documents.
4. Fabrication and procurement activities.
5. Temporary construction activities and relocations
6. Permitting
7. Erosion control
8. Site clearing
9. Site restoration
10. All requirements for coordination with Owner operations
11. Concrete curing and form removal
12. All testing activities
13. Inspections as required by local authorities.
14. Interim Milestones as defined by this Contact or as deemed critical as the project progresses.
15. All requirements related to facility startup and commissioning.
16. Substantial Completion (including the period for performing the punchlist)

17. Final Completion

1.06 TIME IMPACT ANALYSIS

A. General:

1. Prepare and submit a time impact analysis when one or more of the following occurs:

    a. Change Order proposal is prepared

    b. Work Change Directive is issued that will affect the Progress Schedule

    c. When delays are experienced.

2. Time impact analysis shall illustrate the influence of each Change Order, Work Change Directive, or delay.

3. Each time impact analysis shall include a sketch (fragnet) demonstrating how Contractor proposes to incorporate the changes in the Project or, as applicable, delays into the Progress Schedule. Fragnet shall include all logic, and additions required as result of said Change Order, Work Change Directive, or delay.

4. Fragnet shall show all CPM logic revisions for the Work associated with the Change Order, Work Change Directive, or delay and its relationship to other Activities in the Network Diagram.

5. Timing of Time Impact Analysis:

    a. Submit each time impact analysis within 7 days after the following, as applicable:

        1) Start of the delay.

        2) After the submittal of Change Order proposal to Engineer

        3) After Contractor’s Receipt of Work Change Directive.

    b. Failure to Submit Time Impact Analysis: When General Contractor does not submit time impact analysis for a specific change or delay under the General Contract, within the specified period of time for such submittal, such non-submittal shall be construed that no extension of the Contract Times is required

B. Evaluation by Engineer and Acceptance:

1. Engineer's evaluation of each time impact analysis comprised of complete information will be completed in timely manner after Engineer's receipt. Changes in the Contract Times will be made only by Change Order.

2. When mutual agreement is reached between the parties, on effect of the change or delay in the Project, incorporate into the next Progress Schedule update the associated fragnets illustrating the influence of changes and delays.

1.07 RECOVERY SCHEDULES

A. General:

1. When updated Progress Schedule indicates that the ability to comply with the Contract Times falls 30 or more days behind schedule, and there is no excusable delay, Change Order, or Work Change Directive to support an extension of the Contract Times, Contractor shall prepare and submit a recovery Progress Schedule demonstrating Contractor's plan to accelerate the Project to achieve compliance with the Contract Times (i.e., "recovery" schedule) for Engineer's acceptance.

2. Submit recovery schedule within 14 days after submittal of updated Progress Schedule where need for recovery schedule is indicated.

B. Implementation of Recovery Schedule:

1. At no additional cost to Owner, Contractor shall do one or more of the following:

   a. Furnish additional labor and construction equipment

   b. Employ additional work shifts

   c. Expedite procurement of materials and equipment to be incorporated into the Work

   d. Other measures necessary to complete the Work within the Contract Times.

2. Upon acceptance of recovery schedule by Engineer, incorporate recovery schedule into the next Progress Schedule update.

C. Lack of Action: Contractor's refusal, failure or neglect to submit a recovery schedule, shall constitute reasonable evidence that Contractor is not prosecuting the Work or separable part thereof with the diligence that will ensure completion within the Contract Times. Such lack of action shall constitute sufficient basis for Owner to exercise remedies available to Owner under the Contract Documents

1.08 USE OF FLOAT

A. Total Float and Contract Float belong to the Project and may be used by Owner, Engineer, or Contractor to accommodate modifications, regardless of origination, in the Work or to mitigate the effect of events that may delay performance or completion of the Work.

B. Changes or delays that influence scheduled Work Activities with Float and that do not extend the critical path will not be justification for an extension in Contract Times.

1.09 SUBMITTALS

A. Action/Informational Submittals:

1. Initial Progress Schedules:

   a. Preliminary Progress Schedule with associated Network Diagrams.

   b. Acceptable Progress Schedule with associated Network Diagrams.

2. Progress Schedule Updates:

   a. Progress Schedule updates shall comply with requirements of this Section, and shall include updated Progress Schedule, updated Network Diagram when relationships among Activities are changed.

   b. Submit updated Progress Schedule at each progress meeting.

3. Time Impact Analyses: Submit in accordance with this Section.

4. Recovery Schedule: Submit in accordance with this Section.

5. Qualifications: Progress Schedule preparer, and other personnel that will assist Progress Schedule preparer in preparing and maintaining the Progress Schedule.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Contractor shall provide submittals in accordance with the General Contract Conditions as modified by the Special Contract Conditions, and this Section.

2. Contractor is responsible to confirm and correct dimensions at the Site, for information pertaining to the fabrication processes and to techniques of construction, and for coordinating the work of all trades. Contractor's signature of submittal's stamp and letter of transmittal shall be Contractor's representation that Contractor has met his obligations under the Contract Documents relative to that submittal.

B. Related Sections:

1. Section 01 25 00 – Substitution Procedures.

2. Section 01 78 23 – Operations and Maintenance Data.

3. Section 01 78 39 – Project Record Documents.

4. Section 01 78 43 – Spare Parts and Extra Material.

5. Section 01 79 00 – Instruction of Owner's Personnel.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Types of Submittals: When type of submittal is not specified and is not specified in this Section, Engineer will determine type of submittal.

1. Action/Informational Submittals:

a. Shop Drawings.

b. Product data.

c. Delegated design submittals in accordance with the General Contract Conditions and as modified by the Special Contract Conditions.

d. Samples.

e. Testing plans, procedures, and testing limitations.

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f. Design data not sealed and signed by a design professional retained by Contractor, Subcontractor, or Supplier.

g. Pre-construction test and evaluation reports, such as reports on pilot testing, subsurface investigations, potential Hazardous Environmental Conditions, and similar reports.

h. Supplier instructions, including installation data, and instructions for handling, starting-up, and troubleshooting.

i. Sustainable design submittals (other than sustainable design closeout documentation).

j. Lesson plans for training and instruction of Owner's personnel.

2. Closeout Submittals:

a. Maintenance contracts.

b. Operations and maintenance data.

c. Bonds, such as maintenance bonds and bonds for a specific product or system.

d. Warranty documentation.

e. Record documentation.

f. Sustainable design closeout documentation.

g. Software.

3. Maintenance Material Submittals:

a. Maintenance materials schedule and checklist.

b. Spare parts.

c. Extra stock materials.

d. Tools.

4. Quality Assurance Submittals:

a. Performance affidavits.

b. Certificates.

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c. Source quality control submittals (other than testing plans, procedures, and testing limitations), including results of shop testing.

d. Field or Site quality control submittals (other than testing plans, procedures, and testing limitations), including results of operating and acceptability tests at the Site.

e. Supplier reports.

f. Special procedure submittals, including health and safety plans and other procedural submittals.

g. Qualifications statements.

B. Submittal Requirements:

1. Contractor shall submit electronic copy of submittals for Engineer's review via Procore Document Management, unless otherwise specified in individual Specification Sections. Acceptable electronic formats are Adobe PDF, Microsoft Word, Autodesk DWF and AutoCAD.

2. Submittals shall be furnished in two dimensional PDF format.

3. Submittal shall be accompanied by letter of transmittal containing date, project title, Contractor's name, number and title of submittal, list of relevant Specification Sections, notification of deviations from Contract Documents, and other material required for Engineer's review.

C. Scheduling:

1. Provide submittals well in advance of the Work following Engineer's approval or acceptance of the associated submittal. Work covered by a submittal will not be included in progress payments until approval or acceptance of related submittals has been obtained in accordance with the Contract Documents.

2. Submittals shall be provided by Contractor with at least thirty (30) working days for review and processing.

1.03 SCHEDULE OF SUBMITTALS

A. Schedule of Submittals, as specified in this Section:

1. Timing:

a. Provide submittal within time frames specified in the Contract Documents.

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b. Provide updated Schedule of Submittals with each submittal of the updated Progress Schedule.

2. Content: In accordance with the General Contract Conditions as modified by the Special Contract Conditions, and this Section. Requirements for content of preliminary Schedule of Submittals and subsequent submittals of the Schedule of Submittals are identical.

   a. Identify submittals required in the Contract Documents. Updates of Schedule of Submittals shall show scheduled dates and actual dates for completed tasks. Indicate submittals that are on the Project's critical path.

   b. Indicate the following for each submittal:

      1) Date when submittals are requested and received from Supplier.

      2) Date when certification is received from Supplier and when submitted to Engineer.

      3) Date when submittals are submitted to Engineer and returned with disposition from Engineer.

      4) Date when submittals are revised by Supplier and submitted to Engineer.

      5) Date when submittals are returned with "Furnish as Submitted" (FAS) or "Furnish as Corrected" (FAC) disposition from Engineer.

      6) Date when three (3) hardcopy prints of submittals with "Furnish as Submitted" (FAS) or "Furnish as Corrected" (FAC) disposition from Engineer are provided per Article 1.08 of this Section.

      7) Date when approved submittals are returned to Supplier.

      8) Date of Supplier scheduled delivery of equipment and material.

      9) Date of actual delivery of equipment and material.

      10) Whether submittal will be for a substitution or "equal". Procedures for substitutions and "or equals" are specified in the General Contract Conditions and the Section 01 25 00 – Substitution Procedures.

      11) For submittals for materials or equipment, date by which material or equipment must be at the Site to avoid delaying the Work and to avoid delaying the work of other contractors.

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3. Prepare Schedule of Submittals using same software, and in same format, specified for Progress Schedules.

4. Coordinate Schedule of Submittals with the Progress Schedule.

5. Schedule of Submittals that is not compatible with the Progress Schedule, or that does not indicate submittals on the Project's critical path, or that places extraordinary demands on Engineer for time and resources, is unacceptable. Do not include submittals not required by the Contract Documents.

6. In preparing Schedule of Submittals:

   a. Considering the nature and complexity of each submittal, allow sufficient time for review and revision.

   b. Reasonable time shall be allowed for: Engineer's review and processing of submittals, for submittals to be revised and resubmitted, and for returning submittals to Contractor.

   c. Identify and accordingly schedule submittals that are expected to have long anticipated review times.

1.04 ACTION/INFORMATIONAL SUBMITTALS

A. Provide the following Submittals in accordance with the individual Specification Sections, including, but not limited to, the following:

1. Product Data:

   a. Catalog cut-sheets

   b. Descriptive bulletins/brochures/specifications

   c. Material of construction data, including details on all components including applicable ASTM designations.

   d. Lifting, erection, installation, and adjustment instructions, and recommendations.

   e. Finish/treatment data, including interior and exterior shop coating systems.

   f. Equipment/material weight/loading data, including total uncrated weight of the equipment plus the approximate weight of shipped materials. Support locations and loads that will be transmitted to bases and foundations following installation. Size, placement, and embedment requirements of anchor bolts.

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g. Complete information regarding location, type, size, and length of all field welds in accordance with "Standard Welding Symbols" AWS A2.0 of the American Welding Society. Special conditions shall be fully explained by notes and details.

h. Motor data including horsepower; enclosure type; voltage; insulation class; temperature rise and results of dielectric tests; service-rating; rotative speed; motor speed-torque relationship; efficiency and power factor at ½, ¾, and full load; slip at full load; running, full load, and locked rotor current values; safe running time-current curves; motor protective devices; and interconnection diagrams.

i. Engineering design data, calculations, and system analyses

j. Digital system documentation

k. Operating sequence descriptions

l. Software/programming documentation

m. Manufacturer’s instructions

2. Shop Drawings:

a. Equipment and material layout drawings, including panel layout drawings.

b. System schematics and diagrams including, but not limited to, piping systems; HVAC and ventilation systems; process equipment systems; electrical operating systems; wiring diagrams; controls, alarm and communication systems.

c. Layout and installation drawings (interior and exterior) for all pipes, valves, fittings, sewers, drains, heating and ventilation ducts, all electrical, heating, ventilating and other conduits, plumbing lines, electrical cable trays, lighting fixture layouts, and circuiting, instrumentation, interconnection wiring diagrams, communications, power supply, alarm circuits, etc.

d. Layout and installation drawings shall show connections to structures, equipment, sleeves, valves, fittings, etc.

e. Drawings shall show the location and type of all supports, hangers, foundations, etc., and the required clearances to operate valves, equipment, etc.

f. Drawings for pipes, ducts, conduits, etc., shall show all 3 inch and larger electrical conduits and pressure piping, electrical cable trays, heating and ventilation ducts or pipes, structure, manholes or any other feature

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within four (4) feet (measured as the clear dimension) from the pipe duct, conduit, etc., for which the profile is drawn.

g. Drawings showing the layout of equipment, piping, fixtures, conduit runs, electrical gear, ducting and all fabricated and manufactured items for inclusion into the project, shall be drawn and submitted at the scale used on the Contract Drawings for the Plan, Sectional Plans, Sections, and Details for that particular building or installation.

h. Equipment and material schedules.

3. Delegated design submittals, which include documents prepared, sealed, and signed by a design professional retained by Contractor, Subcontractor, or Supplier for materials and equipment to be incorporated into the completed Work. Delegated design submittals do not include submittals related to temporary construction unless specified otherwise in the related Specification Section. Delegated design submittals include: design drawings, design data including calculations, specifications, certifications, and other submittals prepared by such design professional.

B. Samples:

1. General Requirements:

a. Conform submittal of Samples to the General Contract Conditions as modified by the Special Contract Conditions, this Section, and the Specification Section in which the Sample is specified.

b. Furnish at the same time Samples and submittals that are related to the same unit of Work or Specification Section. Engineer will not review submittals without associated Samples and will not review Samples without associated submittals.

c. Samples shall clearly illustrate functional characteristics of product, all related parts and attachments, and full range of color, texture, pattern, and material.

2. Submittal Requirements:

a. Securely label or tag Samples with submittal identification number. Label or tag shall not cover, conceal, or alter appearance or features of Sample. Label or tag shall not be separated from the Sample.

b. Submit number of Samples required in Specifications. If number of Samples is not specified in the associated Specification Section, provide at least one identical Samples of each item required for Engineer's approval. If Contractor requires Sample(s) for Contractor's use, notify

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Engineer in writing and provide additional Sample(s). Contractor is responsible for furnishing, shipping, and transporting additional Samples.

c. Deliver one Sample to Engineer's field office at the Site. Deliver balance of Samples to location directed by Engineer.

1.05 CONSTRUCTION VIDEO AND PHOTOGRAPHS

A. Videotape

1. The Contractor shall pay for videotaping of the site prior to construction and submit the videotape or digital file to the Owner prior to proceeding with work at the site.

B. Digital Photographs

1. The Contractor shall engage and pay for digital photographs each month at the locations and at such stages of the construction as directed by Engineer. All digital photographs shall be at least 9.0 megapixel in resolution.

2. Provide at least 90 photographs per month at the Water Treatment Plant site, evenly spaced with respect to time, during construction at the site. The first series of photographs shall be taken prior to start of work.

3. Provide a total of 10 sets of 5 aerial photographs during the construction work, to be scheduled by the Owner, for the Water Treatment Plant site only. Additional sets of 5 aerial photographs shall be taken before construction work and after construction work. The Contractor shall provide 1 set of hard copies of aerial photos, printed on 8 ½ by 11 sheets, as well as, one copy of the digital photo files submitted on compact disc. Printouts should be supplied within plastic sleeves and with suitable binders to accommodate the number of photos.

C. Submittal Requirements

1. Two copies of the digital photo files shall be submitted to the Engineer on compact disc not later than the fifth day of every month with the application for progress payment. Each of the compact disks should be supplied with a printout of photographs contained on the disk. Thumbnail photos are acceptable, and not to exceed 12 photos per 8 ½ by 11 sheet. Printouts should be supplied within plastic sleeves and with suitable binders to accommodate the number of photos.

2. At the end of the project, two copies of compact discs shall be submitted that contain the copies of all electronic photos taken throughout the project, with a set of printouts similar to that described in the paragraph above.

3. Two glossy prints of each aerial photograph, at least eight-inches by ten-inches in size, with the date, photographer's identification and description affixed thereto, shall be submitted to Engineer not later than the fifth day of

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every month with the application for progress payment. The photographs should be supplied in plastic sleeves and with suitable binders to accommodate the number of photos.

1.06 CLOSEOUT SUBMITTALS

A. Provide the following Closeout Submittals in accordance with the individual Specification Sections, including, but not limited to, the following:

1. Maintenance contracts
2. Bonds for specific products or systems
3. Warranty documentation
4. Sustainable design closeout documentation.
5. Software programming and documentation.

B. On documents such as maintenance contracts and bonds, include on each document furnished original signature of entity issuing the document.

C. Operations and Maintenance Data: Submit in accordance with Section 01 78 23 – Operations and Maintenance Data.

D. Record Documentation: Submit in accordance with Section 01 78 39 – Project Record Documents.

E. Disposition: Dispositions and meanings are the same as specified for Action/Informational Submittals.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. For spare parts, extra stock materials, and tools, submit quantity of items specified in associated Specification Section. Furnish in accordance with Section 01 78 43 – Spare Parts and Extra Material.

B. Disposition: Dispositions and meanings are the same as specified for Action/Informational Submittals.

1.08 CONTRACTOR'S RESPONSIBILITIES

A. Contractor shall review, coordinate, and verify submittals with Subcontractors, Manufacturers, and Suppliers, including field measurements at Site, in accordance with the General Contract Conditions and as modified by Special Contract Conditions prior to submitting material for Engineer's review.

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B. Contractor shall provide Contractor's stamp of approval certifying submittal material has been reviewed and conform to the Contract Documents prior to submitting material for Engineer's review.

C. Contractor shall provide written notice of deviations or variations that submittal may have with the Contract Documents.

D. Contractor shall provide bound, dated, labeled, tabulated, and consecutively numbered submittals as specified in the individual Specification Section. Label shall contain the following:

1. Specification Section.

2. Referenced Drawing number.

3. Subcontractor or Supplier name.

4. Type of equipment and/or materials.

E. Contractor shall perform the following after receiving Engineer's review disposition:

1. Order, fabricate, or ship equipment and materials included in the submittal (pending Engineer's review of source quality control submittals) with the following disposition:

a. "Furnish as Submitted" (FAS).

b. "Furnish as Corrected" (FAC).

c. "Furnish as Corrected – Confirm" (FACC), only portions of Work that do not require resubmittal for Engineer's review.

2. Resubmittal requirements:

a. Partial resubmittal of "Furnish as Corrected – Confirm" (FACC) returned dispositions, until Engineer's disposition is either "Furnish as Submitted" (FAS) or "Furnish as Corrected" (FAC).

b. Full resubmittal of material with Engineer's disposition of "Revise and Resubmit" (R&R) or "Rejected" (R), until Engineer's disposition is "Furnish as Submitted" (FAS), "Furnish as Corrected" (FAC), or "Furnish as Corrected – Confirm" (FACC) that requires a partial resubmittal.

c. Contractor shall be responsible for Engineer's charges to Owner if submittals are not approved within the number of specified submittals in accordance with the General Contract Conditions. Engineer's charges

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shall include, but not limited to, additional review effort, meetings, and conference calls with Contractor, Subcontractor, or Supplier.

3. Provide three (3) hardcopy prints of submittals with the following disposition to the Engineer:

   a. “Furnish as Submitted” (FAS).

   b. “Furnish as Corrected” (FAC).

1.09 ENGINEER’S REVIEW

A. Engineer’s review of the Contractor’s submittal shall not relieve Contractor’s responsibility under the Contract Document in accordance with the General Contract Conditions and as modified in the Special Contract Conditions. An acceptance of a submittal shall be intended to mean the Engineer does not have specific objection to the submitted material, subject to conformance with the Contract Drawings and Specifications.

B. Engineer’s review of Contractor’s submittal shall be confined to general arrangement and compliance with the Contract Documents, and shall not be for the purpose of checking dimensions, weights, clearances, fittings, tolerances, interferences, coordination of Subcontractor work, etc.

C. Review Dispositions:

1. “Furnish as Submitted” (FAS) – No exceptions are taken.

2. “Furnish as Corrected” (FAC) – Minor corrections are noted for Contractor’s correction.

3. “Furnish as Corrected – Confirm” (FACC) – Corrections are noted and partial resubmittal shall be made as noted.

4. “Revise and Resubmit” (R&R) – Corrections are noted and complete resubmittal shall be made. Submittal does not conform to applicable requirements of the Contract Documents and is not acceptable. Revise submittal and re-submit to indicate acceptability and conformance with the Contract Documents.

5. “Receipt Acknowledged” (RA) –

   a. Information included in submittal conforms to the applicable requirements of the Contract Documents and is acceptable. No further action by Contractor is required relative to this submittal, and the Work covered by the submittal may proceed, and products with submittals with this disposition may be shipped or operated, as applicable.

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b. Information included in submittal is for Project record purposes and does not require Engineer's review or approval.

6. "Rejected" (R) – Information included in submittal does not conform to the applicable requirements of the Contract Documents and is unacceptable. Contractor shall submit products and materials as specified in the Contract Documents or provide required information for substitution as specified in the Contract Documents for consideration by Engineer.

D. Electronic Submittal Return to Contractor: Electronic submittals shall be returned electronically with dispositions provided.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 35 20

CONFINED SPACE ENTRY PLAN

PART 1 – GENERAL

1.01 SUMMARY

A. Owner has determined that portions of the Site or new portions of the Site created as part of this Contract may constitute confined spaces or permit-required confined spaces, as defined in this Section.

B. Contractor shall provide appropriate measures, including labor, supervision, equipment, protective devices, and incidentals, to protect the health and safety of personnel at the Site relative to confined spaces, and who may be affected by the Work in confined spaces including, without limitation: employees and agents of Contractor, Subcontractors, Suppliers, Owner, and Engineer, while engaged in performance of their respective duties at Site.

C. Comply with requirements of Owner's confined space entry program, if any.

1.02 REFERENCES

A. Definitions: The following words or terms are not defined but, when used in this Section, have the following meaning:

1. "Confined spaces" are areas on or about the Site as defined in 29 CFR 1910.146(b) and 29 CFR 1926.1202. Confined spaces include, but are not limited to: storage tanks, process vessels, bins, boilers and similar spaces; ventilation or exhaust ducts and stacks; manholes, underground utility vaults and chambers, sewers, pipelines, tunnels; and open-topped spaces greater than four feet deep, such as pits, tubs, vaults, and vessels.

2. "Entry permit" means the written or printed document provided by the employer of personnel entering permit-required confined space, to allow and control entry into permit-required confined space and that contains the information specified in 29 CFR 1910.146(f) and 29 CFR 1926.1206.

3. "Permit-required confined space" means confined space as defined in 29 CFR 1926.146(b) and 29 CFR 1926.1202 and that has one or more of the following characteristics:

    a. Contains or has potential to contain a hazardous atmosphere.

    b. Contains material that has potential for engulfing an entrant.

    c. Has internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or floors, or by floor that slopes downward and tapers to a smaller cross-section.

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d. Contains other recognized serious safety or health hazard.

4. “Hot work permit” means the written authorization of employer of personnel entering a confined space to perform operations, such as riveting, welding, cutting, burning, and heating, capable of providing a source of ignition.

5. “Host Employer” means the employer that owns or manages the property where construction is taking place.

6. “Controlling Contractor” is the employer that has overall responsibility for construction at the worksite.

B. Reference Standards: Comply with Laws and Regulations related to protecting personnel working in or entering confined spaces, including:

1. Code of Federal Regulations (CFR), Title 29, Part 1910, Occupational Safety and Health Standards.

2. CFR, Title 29, Part 1926, Safety and Health Regulations for Construction.

1.03 PLAN REQUIREMENTS

A. Review host employer’s existing confined space inventory and entry procedures, if available, in order to prepare Site- and task-specific confined space entry plans which shall be incorporated into Contractor’s Site-specific health and safety plan. Maintain copy of the confined space entry plan at the Site for access by employees, Owner and authorities having jurisdiction. Confined space entry plan shall include:

1. Results of Contractor’s Site-specific hazard assessment to identify confined spaces that are permit-required confined spaces, including list of all such spaces that will be accessed for the Work. Update the list as required throughout the Project.

2. Requirements for safeguarding access to, and restricting non-permitted personnel from access to, permit-required confined spaces during the Work.

3. Project-specific procedures to be followed when entering or accessing permit-required confined spaces.

4. Documentation of training provided to each person that will enter, or work in conjunction with entry to, permit-required confined spaces

5. Update the plan by adding copies of permits issued and records of entry to permit-required confined spaces, as required in this Section.

B. Confined Space Safety:

1. Personnel entering confined space shall be trained in accordance with 29 CFR 1926.1207and 29 CFR 1910.146(g).

2. Comply with 29 CFR 1926 Subpart AA and requirements of authorities having jurisdiction.

3. Recordkeeping: Using forms required by Contractor, Owner, or authority having jurisdiction, issue for each instance of access to permit-required confined space, completed permit(s) and complete associated data sheet. File completed permits and data sheets in the Site-specific confined space entry plan and submit in accordance with this Section.

    a. Permit for entry to permit-required confined space(s).

    b. Permit for hot work in permit-required confined space(s).

    c. Complete confined space data sheet.

1.04 SUBMITTALS

A. If acceptable, written response for Submittals required in this Section will not be returned to Contractor.

B. Submit the following to Owner; if submittals under this Section are furnished to Engineer, Engineer will forward all submittals under this Section to Owner without review.

1. Procedures: Site-specific confined space entry plan, submitted upon request of Owner.

2. Permits and Reports: For each time personnel enter a confined space, copies of completed permits required for confined space entry, and completed confined space data sheets, submitted upon request of Owner.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 01 35 45
HAZARDOUS MATERIALS CONTROL

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Known Hazardous Materials
2. Unforeseen Hazardous Materials
3. Hazardous Materials Investigation and Remediation
4. Hazardous Waste Management and Regulatory Compliance

1.02 RELATED SECTIONS

A. Section 01 20 00 – Measurement and Payment

B. Section 02 24 20 - Soil Sampling and Analysis

C. Section 02 82 33 – Removal and Disposal of Asbestos Containing Materials

D. Section 02 83 33 – Removal and Disposal of Lead Containing Materials

E. Section 02 84 33 – Removal and Disposal of PCBs

F. Section 02 85 10 – Removal and Disposal of Mercury

1.03 REFERENCES

A. Competent Person: One who is capable of identifying existing and predictable hazards in the work area or unsanitary, hazardous, or dangerous working conditions, and who has authority to take prompt corrective measures (29 CFR 1926.32(f))

B. Large Quantity Generator (LQG): A facility that generates (in a calendar month) ≥1,000 kg of total hazardous waste or >1 kg of acute hazardous waste or >100 kg of acute hazardous waste spill residue or soil, or at any time stores hazardous and acute hazardous wastes in greater quantities (at any time) than 6,000 kg of hazardous waste, 1 kg acute hazardous waste, or 100 kg of acute hazardous waste spill residue or soil.

1.04 DESCRIPTION

A. Known Hazardous Materials

1. There are materials present within the designated Work areas that will require special handling and other safeguard measures in order to minimize chemical exposure hazards to site workers and to prevent environmental impacts to offsite areas. As applicable to its Work, the Contractor shall incorporate these minimum requirements into its Health and Safety Plan (HASP) or other applicable submittal to ensure a safe and healthful working environment.

    a. Upon completion of any additional material sampling at the Work Site(s), the Contractor's HASP shall be updated as needed to incorporate new data generated by analysis of the samples.

2. The Contractor shall not initiate or proceed with any Work in areas associated with the contaminated, potentially hazardous, or hazardous materials until these materials have been removed from these areas or managed in accordance with the following Specifications:

    a. Asbestos-containing material shall be handled in accordance with Section 02 82 33 – Removal and Disposal of Asbestos Containing Materials

    b. Lead-containing paint shall be handled in accordance with Section 02 83 33 – Removal and Disposal of Lead Containing Materials

    c. PCB-containing material shall be handled in accordance with Section 02 84 33 – Removal and Disposal of PCBs

    d. Mercury-containing material shall be handled in accordance with Section 02 85 10 – Removal and Disposal of Mercury

3. The Contractor shall attend an initial site inspection, a coordination conference, and any other meetings to review hazardous materials control issues in connection with the progress of the Work. The initial site inspection and coordination conference shall be as described below. Other meetings to monitor hazardous materials control issues associated with the Work, including any briefing of Owner personnel shall be scheduled as necessary.

    a. Initial Site Inspection: Within five (5) business days after Work commencement date in the Notice to Proceed, the Contractor, the Engineer, and applicable Owner personnel shall perform an initial site inspection to review all the Work areas that will be affected by contaminated, potentially hazardous and hazardous materials.

        1) Initial site inspection shall be organized by the Contractor who shall contact the Owner, and the Engineer to determine the representatives that should attend.

2) Competent Persons shall lead the site inspection.

3) Wipe sampling or sampling outside of the Work to be performed may not be performed without Owner approval.

4) A site inspection report shall be distributed by the Contractor at the beginning of the site inspection. The site inspection report shall include drawing(s) and associated text that describes the work in sufficient detail to aid in the site inspection.

5) The Contractor shall note in the site inspection report any special requirements that they have to perform their Work during the inspection.

6) The Contractor shall prepare and distribute a summary of the site inspection and any comments noted during the inspection to all parties present at the site inspection.

7) In the event that the initial site inspection does not satisfactorily identify the contaminated, potentially hazardous, and hazardous materials potentially affecting the Work, follow-up inspection(s) shall be organized and held as required.

b. Coordination Conference: Within five (5) business days after receipt of the submittals from the initial site inspection, the Engineer will direct the Contractor to schedule and organize a coordination conference. The coordination conference shall be held at the Project Site and shall include Owner personnel as relevant.

1) The coordination conference shall be led by the Contractor.

2) The Contractor shall prepare and distribute a summary of the conference and any comments noted during the conference to all parties present at the conference.

c. Coordination Plan: Within 14 business days after the coordination conference, the Contractor shall submit a coordination plan for Work affected by contaminated, potentially hazardous, and hazardous materials, incorporating all the Engineer’s comments, for the Engineer’s approval.

d. Follow-up Conferences: Within 14 business days of receiving the coordination plan, the Engineer will review and notify the Contractor of the approval of the coordination plan or of required changes. In the event

that the plan is not approved, follow-up conference(s) shall be organized and held as required to receive approval.

1) The follow-up conference dates shall be as directed by the Engineer.

B. Unforeseen Hazardous Material

1. The Work Sites may contain unforeseen hazardous materials. When a potentially hazardous material that was previously unforeseen is discovered or an upgrade of its HASP is necessary for managing unforeseen hazardous material, the Engineer will direct the Contractor to engage the services of a hazardous materials specialist to perform the necessary investigation, develop a remediation plan, and perform the remediation work. Additionally, the Engineer will direct the Contractor to update its HASP as necessary.

2. The Contractor shall be responsible for identifying previously unknown and suspect hazardous materials as they are encountered using approved techniques and analytical methodologies. The Contractor shall submit a sampling plan to the Engineer for acceptance prior to sample collection. Indication of the presence of hazardous materials, including but not limited to odorous or stained soils, sediment or liquids, mercury sources and suspect asbestos containing materials must be immediately reported to the Engineer. All Work in the area shall stop until otherwise directed by the Engineer.

3. In the event that hazardous material is detected, the Engineer will provide the Contractor with a scope of work for the remediation services and direct the Contractor to obtain cost proposals for such work from at least three (3) hazardous material specialists unless otherwise required by the Owner depending upon the magnitude and timing of the work. The Contractor shall submit the proposals, indicating which hazardous material specialist the Contractor proposes to engage, to the Engineer within ten (10) business days of receiving the scope of remediation work. The Engineer shall review the proposals and approve such selection or direct the Contractor to submit an alternative selection or obtain additional proposals. Remediation work shall not commence until the Contractor receives written notice from the Engineer to proceed with the work. As directed by the Engineer, pre-remediation inspections and coordination may also be required, in a manner similar to the procedures for known hazardous materials.

4. Soils testing and analysis shall be performed in accordance with Section 02 24 20 - Soil Sampling and Analysis. In the event that hazardous levels of lead are detected in soil, the Owner will provide the Contractor with a Community Air Monitoring Program (CAMP) to include particulate air monitoring. The Engineer will direct the Contractor to obtain cost proposals for work of the

CAMP from at least three (3) experienced firms unless otherwise required by the Owner depending upon the magnitude and timing of the work. Within five (5) business days of receiving the CAMP, the Contractor shall submit the cost proposals to the Engineer, indicating which firm the Contractor proposes to engage. The Engineer shall review the cost proposals and approve such selection or direct the Contractor to submit an alternative selection or obtain additional proposals. CAMP work shall not commence until the Contractor receives written notice from the Engineer to proceed with the work.

5. The Contractor shall not initiate or proceed with any other Work in areas associated with contaminated, potentially hazardous, or hazardous materials until these materials have been removed from these areas or managed, "in accordance with the following Specifications:

    a. Asbestos-containing material shall be handled in accordance with Section 02 82 33 – Removal and Disposal of Asbestos Containing Materials

    b. Lead-containing paint shall be handled in accordance with Section 02 83 33 – Removal and Disposal of Lead Containing Materials

    c. PCB-containing material shall be handled in accordance with Section 02 84 33 – Removal and Disposal of PCBs

    d. Mercury-containing material shall be handled in accordance with Section 02 85 10 – Removal and Disposal of Mercury

6. Some of the remediation work may be critical to maintaining construction schedules. When this occurs, the Engineer will establish a time for completion.

C. Hazardous Waste Management and Regulatory Compliance

1. Hazardous Waste Contingency Plan and Hazardous Waste Minimization Plan

    a. If the location of the project is on a site which has a Large Quantity Generator (LQG) status or subsequently obtains LQG status during the course of the Work, then the Contractor shall conform to the requirements of the Hazardous Waste Contingency Plan and Hazardous Waste Minimization Plan for that site.

2. Hazardous Waste Storage Compliance

    a. The Contractor shall maintain compliance with hazardous waste storage requirements at the Work Site. Storage areas and inspections of storage areas must comply with the hazardous waste regulations detailed within 6 NYCRR Parts 370 through 375.

3. Waste Management Records

    a. Disposal of wastes generated by remediation Work will be based on the results of testing and shall be at a site permitted to accept such waste by the U.S. Environmental Protection Agency (EPA) or an authorized state or local government agency. The Contractor shall provide remediation waste profiles for Owner signature as generator, permit documentation required for the selected Treatment, Storage, or Disposal Facility (TSDF) to receive these wastes, and the transporter's 6 NYCRR Part 364 Waste Transporter Permit(s) required to transport wastes to the TSDF. The Contractor will conduct due diligence of the TSDF, including a list of violations received. The Contractor shall also provide advance copies of the waste manifest(s) for the Engineer's review and approval. The Contractor will keep and update a Hazardous Waste Inventory Log and will document weekly inspections by a Competent Person in the management of hazardous waste.

    b. The Contractor shall submit written evidence that selected TSDF's will accept or have accepted the wastes generated during remediation. The Contractor shall also submit copies of the completed manifest, signed and dated by the initial transporter, in accordance with federal and state requirements and with associated documentation (e.g., Waste Profile and Hazardous Waste Land Disposal Restrictions (LDR) Notification and Certification Form). Copies of completed and signed waste manifests from TSDF's shall be provided to the Engineer as soon as possible but no later than thirty (30) days of waste shipment offsite.

4. Changes to Hazardous Waste Generator Status

    a. The Contractor shall be aware that work activities may result in a change to the Work Site's hazardous waste generator status. Compliance with the revised generator status is required.

5. Hazardous Waste Regulatory Program Fees and Taxes

    a. The Contractor may be directed to pay the New York State Department of Taxation and Finance for special assessments on hazardous waste generated at the Project Site or the NYSDEC regulatory program fees charged to the facility operating at the Site. When directed by the Engineer, the Contractor shall pay the amount indicated within 48 hours of notification. The Contractor will be reimbursed for the amount paid, with no provision for overhead and profit, from the allowance provided for unforeseen hazardous materials remediation as specified in Section 01 20 00 – Measurement and Payment.

1.05 QUALITY ASSURANCE

A. Remediation plans for unforeseen hazardous materials shall comply with all applicable requirements of federal, state, and local hazardous waste regulations and shall include, but not be limited to the following:

1. Identification of hazardous and regulated/non-hazardous wastes associated with the Work.

2. Estimated quantities of wastes to be generated and disposed of.

3. Names and qualifications of each Subcontractor that will be testing, transporting, storing, and disposing of wastes. Include the facility location and a 24-hour telephone contact number and applicable transporter and TSDF permits, EPA Identification Numbers, and insurance certificates.

4. Names and qualifications (experience and training) of personnel who will be responsible for on-site management of hazardous wastes.

5. Detailed description of the containment and removal procedures.

6. List of waste handling equipment to be used in performing the remediation Work, to include cleaning, volume reduction, and transport equipment.

7. Spill prevention and cleanup contingency measures to be implemented.

8. Work plan for waste management, on-site storage, removal and disposal.

9. Detailed schedule indicating the beginning and completion dates for each activity and each Work area, including time for clean-up, inspection, and monitoring activities.

1.06 SUBMITTALS

A. The following items shall be submitted as described above for the Engineer’s approval:

1. Site Inspection Report

2. Coordination Plan for Known Hazardous Materials and, when required, for Unknown Hazardous Materials.

3. Remediation Plan for Unforeseen Hazardous Materials, when required.

4. Three (3) cost proposals from hazardous materials specialists for remedial action work, when required.

5. Written evidence of disposal of hazardous and non-hazardous waste at an approved facility in accordance with the requirements of this Section.

B. The Contractor, when requested by the Engineer, shall provide additional copies of all reports and related materials as may be needed for conferences with the Owner and other agencies having jurisdiction.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 42 00

REFERENCES

PART 1 – GENERAL

1.01 SUMMARY

A. Definitions and terminology applicable to all the Contract Documents are included in the General Contract Conditions and Special Contract Conditions.

1.02 REFERENCES

A. Abbreviations and Acronyms: Common abbreviations that may be found in the Contract Documents are listed below:

alternating current	a-c
Americans with Disabilities Act	ADA
Americans with Disabilities Act Accessibility Guidelines	ADAAG
ampere	A
ante meridian	a.m.
Architectural Barriers Act	ABA
average	avg
biochemical oxygen demand	BOD
brake horsepower	bhp
British thermal unit	Btu
Centigrade (or Celsius)	C
chlorinated polyvinyl chloride	CPVC
Code of Federal Regulations	CFR
cubic feet per minute	cfm
cubic feet per second	cfs
cubic foot	cu ft
cubic inch	cu in
cubic yard	cdu yd, or CY
degree Centigrade (or Celsius)	degrees C or ºC
degrees Fahrenheit	degrees F or ºF
diameter	dia
direct current	d-c
dollars	$
each	ea
efficiency	eff
Fahrenheit	F
feet	ft
feet per hour	fph
feet per minute	fpm
feet per second	fps

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figure	Fig
flange	flg
foot-pound	ft-lb
gallon	gal
gallons per hour	gph
gallons per minute	gpm
gallons per second	gps
gram	g
grams per liter	g/L
Hertz	Hz
horsepower	hp or HP
hour	hr
human-machine interface	HMI
inch	in.
inches water gage	in. w.g.
inch-pound	in.-lb
inside diameter	ID
iron pipe size	IPS
kilovolt-ampere	kva
kilowatt	kw
linear foot	lin ft or LF
liter	L
maximum	max
mercury	Hg
milligram	mg
milligrams per liter	mg/l or mg/L
milliliter	ml
millimeter	mm
million gallons	MG
million gallons per day	mgd or MGD
minimum	min
national pipe threads	NPT
net positive suction head	NPSH
net positive suction head available	NPSHA
net positive suction head required	NPSHR
nominal pipe size	NPS
number	no.
operator interface terminal	OIT
ounce	oz
ounce-force	ozf
outside diameter	OD
parts per billion	ppb

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parts per hundred	pph
parts per million	ppm
programmable logic controller	PLC
polyvinyl chloride	PVC
post meridian	p.m.
pound	lb
pounds per square foot	psf
pounds per square inch	psi
pounds per square inch absolute	psia
pounds per square inch gauge	psig
process control system	PCS
programmable logic controller	PLC
revolutions per minute	rpm
second	sec
specific gravity	sp gr or SG
square	sq
square foot	sq ft or sf
square inch	sq in.
square yard	sq yd or SY
standard	std
standard cubic feet per minute	scfm
thousand pounds	kips
thousand pounds per square inch	ksi
total dynamic head	TDH

B. Definitions: Terminology used in the Specifications includes, but is not limited to, the following:

1. “Indicated” refers to graphic representations, notes, or schedules on the Drawings, or to other paragraphs or schedules in the Specifications and similar locations in the Contract Documents.

2. “Shown”, “noted”, “scheduled”, and “specified” are used to help the user locate the reference without limitation on the location.

3. “Installer”, “applicator”, or “erector” is Contractor or another entity engaged by Contractor, either as an employee or subcontractor, to perform a particular construction activity, including installation, erection, application or similar Work. Installers shall be experienced in the Work that installer is engaged to perform.

4. “Experienced”, when used with the term “installer” means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; being familiar with Laws and Regulations; and having complied with requirements of authorities

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having jurisdiction and complying with requirements of the Supplier of the material or equipment being installed.

5. Trades: Use of a term such as “carpentry” does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as “carpenter”, unless otherwise indicated in the Contract Documents or required by Laws or Regulations. Such terminology also does not imply that specified requirements apply exclusively to trade personnel of the corresponding generic name.

6. “Assigned specialists” and similar terms: Certain Sections of the Specifications require that specific construction activities be performed by specialists recognized as experts in those operations. Engage said specialists for those activities, and their engagement is a requirement over which Contractor has no option. These requirements do not conflict with enforcement of building codes and other Laws and Regulations. Also, such requirements are not intended to interfere with local trade union jurisdictional settlements and similar conventions. Such assignments shall not relieve Contractor of responsibility for complying with the requirements of the Contract Documents.

C. Reference Standards:

1. Refer to General Contract Conditions, as may be modified by the Special Contract Conditions, relative to reference standards and resolving discrepancies between reference standards and the Contract Documents. Provisions of reference standards are in effect in accordance with the Specifications.

2. Copies of Standards: Each entity engaged in the Work shall be familiar with reference standards applicable to its construction activity. Copies of applicable reference standards are not bound with the Contract Documents. Where reference standards are needed for a construction activity, obtain copies of standards from the publication source.

3. Abbreviations and Names: Where reference standards, specifications, codes, manuals, Laws or Regulations, or other published data of international, national, regional or local organizations are referred to in the Contract Documents, the organization issuing the standard may be referred to by their acronym or abbreviation only.

4. Following acronyms or abbreviations that may appear in the Contract Documents shall have the meanings indicated below. Listing is alphabetical by acronym.

AA	Aluminum Association
AABC	Associated Air Balance Council
AAMA	American Architectural Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ACIFS	American Cast Iron Flange Standards
ACS	American Chemical Society
ADC	Air Diffusion Council
ADSC	International Association of Foundation Drilling.
AEIC	Association of Edison Illuminating Companies
AF&PA	American Forest and Paper Association
ABMA	American Bearing Manufacturers Association (formerly Anti- Friction Bearing Manufacturers Association (AFBMA))
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AHDGA	American Hot Dip Galvanizers Association
AI	Asphalt Institute
AIA	American Institute of Architects
AIChE	American Institute of Chemical Engineers
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ALSC	American Lumber Standards Committee
AMA	Acoustical Materials Association
AMCA	Air Movement and Control Association
AMP	National Association of Architectural Metal Manufacturers, Architectural Metal Products Division
ANSI	American National Standards Institute
APA	The Engineered Wood Association
API	American Petroleum Institute
APHA	American Public Health Association
AREA	American Railway Engineering Association
ARI	Air Conditioning and Refrigeration Institute
ASA	American Standards Association
ASAE	American Society of Agricultural Engineers
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASNT	American Society for Non-Destructive Testing
ASQ	American Society for Quality
ASSE	American Society of Safety Engineers
ASTM	American Society for Testing and Materials
AWCI	Association of the Wall and Ceiling Industry

AWI	Architectural Woodwork Institute
AWPA	American Wood Protection Association
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BAAQMD	Bay Area Air Quality Management District
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Industry Association
BOCA	Building Officials and Code Administrators
CBMA	Certified Ballast Manufacturers Association
CDA	Copper Development Association
CEMA	Conveyor Equipment Manufacturers Association
CGA	Compressed Gas Association
CISCA	Ceilings and Interior Systems Construction Association
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturers Institute
CMAA	Crane Manufacturers Association of America
CPSC	Consumer Product Safety Commission
CRSI	Concrete Reinforcing Steel Institute
CSI	Construction Specifications Institute
DEP	Department of Environmental Protection
DIN	Deutsches Institut fur Normung eV (German Institute for Standardization)
DIPRA	Ductile Iron Pipe Research Association
EJCDC	Engineers Joint Contract Documents Committee
EJMA	Expansion Joint Manufacturers Association, Inc.
ETL	Intertek Testing Services, Inc. (formerly ETL Testing Laboratories, Inc.)
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FM	Factory Mutual (FM Global)
FRPI	Fiberglass Reinforced Plastics Institute
FS	Federal Specification
GA	Gypsum Association
GANA	Glass Association of North America
HEW	United States Department of Health, Education and Welfare
HI	Hydraulic Institute
HMI	Hoist Manufacturers Institute
HUD	United States Department of Housing and Urban Development
IBC	International Building Code
ICC	International Code Council
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronics Engineers

IESNA	Illuminating Engineering Society of North America
IFI	Industrial Fasteners Institute
IFCEA	Insulated Power Cable Engineers Association
IRI	Industrial Risk Insurers
ISA	Instrumentation, Systems, and Automation Society (formerly Instrument Society of America)
ISO	Insurance Services Office
IOS	International Organization for Standardization
LPI	Lightning Protection Institute
MIA	Marble Institute of America
ML/SFA	Metal Lath/Steel Framing Association
MS	Military Specifications
MSS	Manufacturers' Standardization Society
MMA	Monorail Manufacturers Association
NAAMM	National Association of Architectural Metal Manufacturers
NACE	National Association of Corrosion Engineers
NAPF	National Association of Pipe Fabricators, Inc.
NARUC	National Association of Regulatory Utilities Commissioners
NBHA	National Builders Hardware Association
NBS	United States Department of Commerce, National Bureau of Standards
NCMA	National Concrete Masonry Association
NEC	National Electric Code
NELMA	Northeastern Lumber Manufacturers' Association
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
NETA	International Electrical Testing Association
NFPA	National Fire Protection Association
NFRC	National Fenestration Rating Council
NGA	National Glass Association
NHLA	National Hardwood Lumber Association
NHPMA	Northern Hardwood and Pine Manufacturers Association
NIST	United States Department of Commerce, National Institute of Standards and Technology
NLGA	National Lumber Grades Authority
NRCA	National Roofing Contractors Association
NRMCA	National Ready Mixed Concrete Association
NSF	National Sanitation Foundation
NSSGA	National Stone, Sand, and Gravel Association
NTMA	National Terrazzo and Mosaic Association
NY	New York
NYC	New York City
NYCRR	New York Codes, Rules and Regulations
NYS	New York State

NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
NYSOPRHP	New York State Office of Parks, Recreation and Historic Preservation
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PCI	Precast/Prestressed Concrete Institute
PEI	Porcelain Enamel Institute
PFI	Pipe Fabrication Institute
PPI	Plastics Pipe Institute
PGMC	Primary Glass Manufacturers Council
PS	Product Standards Section, United States Department of Commerce
RCSC	Research Council on Structural Connections (part of AISC)
RCSD	Rockland County Sewer District No. 1
RMA	Rubber Manufacturers Association
SAE	Society of Automotive Engineers
SBCCI	Southern Building Code Congress International, Inc.
SCAQMD	Southern California Air Quality Management District
SCPRF	Structural Clay Products Research Foundation
SCTE	Society of Cable Telecommunications Engineers
SDI	Steel Deck Institute
SDI	Steel Door Institute
SIGMA	Sealed Insulating Glass Manufacturing Association
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractor’s National Association
SPI	Society of the Plastics Industry
SPIB	Southern Pine Inspection Bureau
SSPC	Society for Protective Coatings
SWI	Steel Window Institute
TCNA	Tile Council of North America
TEMA	Tubular Exchanger Manufacturers Association
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.
USAB	United States Access Board
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
USGBC	United States Green Building Council
USGS	United States Geological Survey
USPHS	United States Public Health Service
WCLIB	West Coast Lumber Inspection Bureau
WCMA	Window Covering Manufacturers Association

WCMA	Wood Component Manufacturers Association
MDMA	Window and Door Manufacturers Association
WWEMA	Water and Wastewater Equipment Manufacturers Association
WWPA	Western Wood Products Association

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 01 45 23

TESTING SERVICES FURNISHED BY CONTRACTOR

PART 1 – GENERAL

1.01 SUMMARY

A. This specification addresses requirements for testing services specifically required to be provided by the Contractor. This section does not apply to any testing required to be provided by the Owner or Owner's representative.

B. This section does not apply to any Special Inspections as required by Section 01 45 33 – Special Inspections. Special Inspections cannot be provided by the Contractor in accordance with the Governing Building Code.

C. Contractor shall employ and pay for independent testing entity to perform specified services covered by this specification. Entity selected shall be subject to approval by Engineer.

D. Inspection, sampling, and testing shall be as specified in the individual Specification Sections.

E. Related Sections, but not limited to, the following:

1. Section 01 45 33 – Special Inspections
2. Section 02 24 20 – Soil Sampling and Analysis
3. Section 02 82 33 – Removal and Disposal of Asbestos Containing Materials
4. Section 02 83 33 – Removal and Disposal of Lead Containing Materials
5. Section 02 84 33 – Removal and Disposal of PCBs
6. Section 02 85 10 – Removal and Disposal of Mercury
7. Section 03 21 00 – Reinforcing Steel.
8. Section 03 30 00 – Cast-in-Place Concrete
9. Section 31 00 01 – Earthwork
10. Section 31 05 16 – Aggregate Materials
11. Section 32 10 00 – Paving and Surfacing

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1.02 ADMINISTRATIVE REQUIREMENTS

A. Contractor's Responsibilities:

1. Provide to laboratory representative samples of materials to be tested, in required quantities.

2. Provide labor and facilities:

   a. To provide access to the Work to be tested, and where required, to Suppliers' operations.

   b. To obtain and handle samples at the Site.

   c. To facilitate inspections and tests.

   d. For testing entity's exclusive use for storage and curing of test samples.

   e. Forms for preparing concrete test beams and cylinders.

3. Notify testing entity and Engineer sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests.

4. Arrange with testing entity and pay for additional services, sampling, and testing required for Contractor's convenience.

5. Provide to testing entity the preliminary design mix proposed for concrete, and other material mixes that require testing by the testing laboratory.

B. Testing Entity's Responsibilities:

1. Cooperate with Contractor and Engineer and provide qualified personnel promptly when notified.

2. Perform specified inspections, sampling, and testing of materials and methods of construction; comply with applicable standards; ascertain compliance with requirements of the Contract Documents.

3. Promptly notify Engineer and Contractor of irregularities or deficiencies in the Work observed during performance of services.

4. Submit specified quantity of report copies of inspections and tests to Contractor and Engineer.

5. Perform additional tests and services as required to ensure compliance with the Contract Documents.

C. Report Requirements:

1. Electronic Submittal of testing reports.

2. Include the following information:

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a. Date issued.

b. Project title, number, and name of the Site.

c. Testing laboratory name and address.

d. Name and signature of inspector or person obtaining samples.

e. Date of inspection or sampling.

f. Record of temperature and weather.

g. Date of test.

h. Identification of material or product tested and associated Specification Section.

i. Location in the Project.

j. Type of inspection or test.

k. Results of tests and observations regarding compliance with the Contract Documents.

1.03 SUBMITTALS

A. Submit copies of material and product test reports where required by the Contract Documents and as requested by Engineer.

B. Quality Assurance Submittals:

1. Qualifications statement indicating experience and facilities for tests required under the Contract Documents.

2. Copy of report of inspection of facilities during most recent NIST inspection tour. Include memorandum of remedies of deficiencies reported during inspection.

3. Copy of certificate of calibration for each instrument or measuring device proposed for use, by accredited calibration agency.

1.04 QUALIFICATIONS

A. Comply with applicable requirements of ASTM E329, Specification for Agencies Engaged in Construction Inspection and/or Testing.

B. Laboratory shall be authorized to operate in New York State. Where applicable, laboratory shall be certified by the authority having jurisdiction for the types of testing required.

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C. Testing equipment used by laboratory will be calibrated at maximum twelve month intervals by devices of accuracy traceable to either NIST's Standard Reference Materials (SRM), ISO 17025, General Requirements for the Competence of Testing and Calibration Laboratories, or certified by State, or local bureau of weights and measures, or values of natural physical constants generally accepted in the engineering and scientific community.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 45 33

SPECIAL INSPECTIONS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. This Section defines the requirements for Special Inspections as required by Section 1704 of the International Building Code (IBC) and any State or local amendments.

B. The Engineer will prepare a Statement of Special Inspections, which identifies the type and extent of required Special Inspections. A sample Statement of Special Inspections is included at the end of this Section.

C. The Owner will retain one or more Special Inspections Agencies to perform Special Inspection services. These Agencies shall be independent from the Contractor and approved by the Building Official. The Engineer of Record may perform Special Inspection services where qualifications for a specific inspection task are met.

D. The Contractor shall plan and conduct his operations as to schedule and allow Special Inspections, providing adequate time and safe access for inspections. The Contractor shall coordinate requirements for Special Inspections with the Special Inspections Agency.

E. Special Inspections shall be in addition to inspections performed by Building Officials that are specified in IBC Section 104.

F. Special Inspections shall be in addition to any Structural Observations required by IBC Section 1704.6.

G. Special Inspections do not supersede other inspections and testing required by the Contract Documents to satisfy the Contractor's quality control responsibility. Contractor shall be responsible for all costs associated with quality control requirements as required by other Sections of the Specifications.

H. Special Inspections shall not relieve Contractor's obligation to perform and complete work in accordance with Contract Documents. Results of Special Inspections activities, including any discrepancies that are noted or not noted, shall never constitute an acceptance of work that is not in accordance with the Contract Documents.

I. This Section does not apply to construction equipment, shoring, earth retention systems, and temporary structures used by the Contractor in construction and not detailed in the Contract Documents. The Contractor shall be solely responsible for means, methods, techniques, sequences, or procedures of construction and any associated building code requirements.

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1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Special Inspections requirements apply to work detailed in other Sections of the Specifications. Special Inspections requirements shall be in addition to any other inspection or quality control

requirements detailed in other Sections of the Specifications. See individual Specification Sections for type of work in question.

1.03 DEFINITIONS

A. Periodic Special Inspections: The part-time or intermittent observation of work requiring Special Inspection by a Special Inspector who is present in the area where the work has been or is being performed and at the completion of the work.

B. Continuous Special Inspections: The full-time observation of work requiring Special Inspection by a Special Inspector who is present in the area where the work is being performed.

C. Engineer: The Registered Design Professional in Responsible Charge of each building system. These systems include structural, mechanical, electrical, and architectural components.

D. Special Inspections Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, which has been approved by the Building Official and is retained by the Owner. The Engineer of Record may serve in this role where qualifications for specific inspection tasks are met.

E. Special Inspector: Individual employed by or retained by the Special Inspections Agency who is qualified in inspection of specific aspects or components of the construction and conducts inspection activities in these specific aspects of the construction, as required by this Section. The Engineer of Record may serve in this role where qualifications for specific inspection tasks are met.

F. Statement of Special Inspections: Document prepared by the Engineer and submitted to the Building Official which identifies the type and extent of required Special Inspections.

G. Approved Fabricator: Fabricator who has been registered and approved by the Building Official to manufacture or fabricate specific components of the construction without Special Inspections.

1.04 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of the other requirements of the Specifications, all work herein shall conform to the applicable requirements of the following documents and all other documents referenced in the Specifications. All referenced Specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. International Building Code

2. New York State Building Code

3. ACI 318 – Building Code Requirements for Structural Concrete

4. TMS 402/TMS 602 – Building Code for Masonry Structures/Specifications for Masonry Structures

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5. AISC – Code of Standard Practice

6. AISC 341 – Seismic Provisions for Structural Steel Buildings

7. AISC 360 – Specification for Structural Steel Buildings

8. AISC 348 – Specification for Structural Joints Using High Strength Bolts

9. AWS – Structural Welding Code

10. ADMI – Aluminum Design Manual: A Specification for Aluminum Structures

1.05 SUBMITTALS

A. The Contractor shall submit the following in accordance with Section 01 33 00 - Submittal Procedures.

1. The Contractor shall submit a written statement of responsibility to the Building Official and Engineer prior to beginning work. A statement is required from each Contractor who has responsibility for construction or fabrication of a main wind- or seismic-force-resisting system, designated seismic system, or a wind- or seismic-resisting-component listed in the Statement of Special Inspections.

2. The Contractor shall submit qualifications of any fabricators they intend to use that may qualify as Approved Fabricators to the Special Inspections Agency for review.

B. The Special Inspections Agency shall submit the following in accordance with Section 01 33 00 – Submittal Procedures.

1. The Special Inspections Agency shall provide a statement of qualifications showing relative experience, training, and certification(s) for each Special Inspector to the Building Official, if requested.

2. The Special Inspections Agency shall review fabricator qualifications and submit them to the Building Official for approval as an Approved Fabricator if requested.

3. Special Inspectors shall keep detailed inspection records, including all inspections, tests, similar services, and any discrepancies and corrections. Any discrepancies and corrections shall be reported to the Building Official and the Engineer in all required reports, unless otherwise required by the Building Official.

4. The Special Inspections Agency shall submit Interim Reports to the Building Official and the Engineer documenting required Special Inspections and correction of any discrepancies at the frequency specified in the Statement of Special Inspections.

5. The Special Inspections Agency shall submit to the Building Official and the Engineer a Final Report documenting required Special Inspections and correction of any discrepancies.

The Final Report shall be submitted at a point in time agreed upon by the Owner and the Building Official at the Pre-inspection Meeting.

6. Where work is done by Approved Fabricators, the Special Inspections Agency shall coordinate the submittal of a certificate of compliance to the Building Official and Engineer.

1.06 SPECIAL INSPECTOR QUALIFICATIONS

A. Special Inspectors shall meet minimum qualifications established by the Building Official and shall be approved by the Building Official.

1.07 OFF-SITE FABRICATIONS

A. When structural elements or assemblies are fabricated off site, Special Inspections are required to be performed in the fabricator's shop unless the fabricator is an Approved Fabricator. Special Inspections are not required if work is done on the premises of an Approved Fabricator.

B. Fabricators shall maintain detailed fabrication and quality control procedures to ensure workmanship and conformance with Contract Documents and reference standards. The Special Inspections Agency shall review the fabricator's quality control procedures and coordinate required Special Inspections with the fabricator and the Contractor.

C. The Contractor shall submit qualifications of fabricators seeking Approved Fabricator status to the Special Inspections Agency for review. Approval as an Approved Fabricator shall be given by the Building Official upon the recommendation of the Special Inspections Agency or upon review of the fabricator's written procedural and quality control manuals and periodic auditing of fabrication practices.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 PRE-INSPECTION MEETING

A. At least two weeks prior to beginning work, a Pre-inspection Meeting shall be held to discuss the Special Inspection procedures and submittals. The following parties shall participate: Design Professional of Record (Engineer), Special Inspections Agency representative, Contractor, Subcontractors, Testing Agencies, and Building Official. The type of meeting (in-person or teleconference) and location of meeting shall be determined by the Building Official.

3.02 STATEMENT AND SCHEDULE OF SPECIAL INSPECTIONS

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A. The Special Inspections Agency and all Special Inspectors are required to comply with all requirements of the Statement of Special Inspections and the Schedule of Special Inspections. Together, these documents identify materials, systems, components, and work that are required

to have Special Inspections, the type and extent of Special Inspections, and whether they will be continuous or periodic.

3.03 SPECIAL INSPECTIONS AGENCY REQUIREMENTS AND RESPONSIBILITIES

A. The Special Inspections Agency shall be an established and recognized agency regularly engaged in conducting tests or furnishing inspection services, which has been approved by the Building Official and is retained by the Owner. The Agency shall demonstrate competence, to the satisfaction of the Building Official, for the inspection of the specific aspects of construction or operation requiring Special Inspection.

B. The Special Inspections Agency shall maintain detailed inspection records, including a copy at the jobsite, and all records shall be available upon request by the Engineer or the Building Official. The Agency shall submit all required reports to the Engineer and Building Official. Where Engineer approval is required for corrections, the Special Inspector shall maintain copies of all related correspondence and submit with all required reports. The Agency shall coordinate all required Special Inspection activities with the Special Inspectors, the Contractor, and any fabricators and shall coordinate designation of fabricators as Approved Fabricators when requested.

3.04 SPECIAL INSPECTORS' REQUIREMENTS AND RESPONSIBILITIES

A. All Special Inspectors shall meet the qualification requirements determined by the Building Official for the specific type of inspection services they will be providing and shall be approved by the Building Official. Special Inspectors shall submit written documentation demonstrating their competence and experience or training to the Building Official for approval of their qualifications.

B. Special Inspections shall be performed in accordance with all requirements of the Statement of Special Inspections, the Schedule of Special Inspections, the IBC, and any State or local amendments. Special Inspectors shall maintain detailed inspection records, including a copy at the jobsite, and all records shall be available upon request by the Engineer or the Building Official. Special Inspectors shall submit all required reports to the Engineer and the Building Official. Where Engineer approval is required for corrections, the Special Inspector shall maintain copies of all related correspondence and submit with all required reports. Special Inspectors shall coordinate inspection requirements and time when inspections can be conducted with the Contractor.

C. Any discrepancies in work noted by the Special Inspector shall be brought to the immediate attention of the Contractor for correction. Special Inspectors shall coordinate correction of discrepancies with the Contractor. Any corrections of discrepancies that result in changes to the work as shown on the Contract Documents shall be approved by the Engineer. If noted discrepancies are not corrected, the Special Inspector shall notify the Contractor, the Engineer and the Building Official. All noted discrepancies and corrections shall be documented in all inspection records and all required reports.

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3.05 CONTRACTOR RESPONSIBILITIES

A. Each Contractor responsible for the construction or fabrication of a main wind- or seismic-force-resisting system, designated seismic system, or a wind- or seismic-resisting-component listed in the Statement of Special Inspections shall submit a Statement of Responsibility to the Building Official and Engineer prior to the commencement of work. The Statement of Responsibility shall contain acknowledgement of the specific requirements contained in the Statement of Special Inspections.

B. The Contractor shall coordinate requirements of Special Inspections with the Special Inspections Agency and the Special Inspectors and shall provide adequate time and access to conduct inspections. The Contractor is solely responsible for providing safe access and any necessary safety equipment required to conduct inspections. The Special Inspector shall not supervise, direct, control, or have authority over or be responsible for the Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of the Contractor to comply with Laws and Regulations applicable to the performance of the Work.

C. Special Inspections shall not relieve the Contractor's obligation to perform and complete work in accordance with the Contract Documents. Results of Special Inspections activities, including any discrepancies that are noted or not noted, shall never constitute an acceptance of work that is not in accordance with the Contract Documents.

D. The Contractor shall provide advance notice of work to be conducted that will require Special Inspections. If the Special Inspector is delayed in inspecting the work due to inadequate notice or completion of the work, the Contractor shall reimburse the Owner for the cost of additional subsequent Special Inspections.

E. The Contractor shall promptly correct any discrepancies noted by the Special Inspectors. Any corrections of discrepancies that result in changes to the work as shown on the Contract Documents shall be approved by the Engineer. Where Engineer approval is required, the Contractor shall report the discrepancy to the Engineer in accordance with provisions of the General Contract Conditions. The Engineer will authorize any changes to the Contract Documents required for the correction in accordance with provisions of the General Conditions. Copies of all correspondence related to the correction shall be submitted concurrently to the Special Inspections Agency.

3.06 BUILDING OFFICIAL OR AUTHORITY RESPONSIBILITIES

A. The Building Official will approve qualifications of the Special Inspections Agency, all Special Inspectors, and any Approved Fabricators. The Building Official will approve all forms submitted by the Contractor, any Approved Fabricators, the Engineer, the Special Inspections Agency, and the Special Inspectors. The Building Official and the Special Inspections Agency shall agree to the frequency of Interim Reports and the submittal deadline for the Final Report.

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3.07 ENGINEER RESPONSIBILITIES

A. The Engineer shall respond to discrepancies noted by the Special Inspector, if required.

3.08 OWNER RESPONSIBILITIES

A. The Owner will retain a Special Inspections Agency to perform Special Inspections during construction.

3.09 MINIMUM INSPECTION REQUIREMENTS

A. Detailed requirements for Special Inspections are shown in the Statement of Special Inspections and the Schedule of Special Inspections, which references the IBC, applicable code standards, and any State or local amendments. Special Inspections shall be performed in accordance with all requirements of the Statement of Special Inspections, the Schedule of Special Inspections, the IBC, and any State or local amendments. Additional requirements for specific materials listed in other Sections of these Specifications shall also be satisfied. The frequency of inspections shall be continuous or periodic as indicated in the Schedule of Special Inspections and in accordance with applicable building codes.

3.10 REPORTS

A. Special Inspectors shall maintain detailed inspection records, including a copy at the jobsite, and all records shall be available upon request by the Engineer or the Building Official. The Special Inspections Agency shall submit all required reports to the Building Official and Engineer as agreed upon with the Building Official. Reports shall indicate the inspections and testing performed and whether work inspected was or was not completed in conformance to Contract Documents and any corrective measures taken. Where Engineer approval is required for corrections, the Agency shall maintain copies of all related correspondence and submit with all required reports.

END OF SECTION

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SAMPLE - STATEMENT OF SPECIAL INSPECTIONS

PROJECT: _____

LOCATION: _____

PERMIT APPLICANT: _____

APPLICANT'S ADDRESS: _____

ARCHITECT OF RECORD: _____

STRUCTURAL ENGINEER OF RECORD: _____

MECHANICAL ENGINEER OF RECORD: _____

ELECTRICAL ENGINEER OF RECORD: _____

REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE: _____

This Statement of Special Inspections is submitted in accordance with Section 1704 of the International Building Code. It shall be considered in conjunction with the Schedule of Special Inspections included in this Section 01 45 33. If applicable, it includes *Requirements for Seismic Resistance and/or Requirements for Wind Resistance*.

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

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

The Special Inspector(s) shall keep detailed records of all inspections, including a copy at the jobsite. All records shall be available upon request by the Engineer or the Building Official. Any discrepancies shall be brought to the immediate attention of the Contractor. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official and the Engineer prior to completion of that phase of work. The Special Inspections Agency shall furnish Interim Reports to the Building Official and to the Engineer at the frequency indicated in the Statement of Special Inspections. A Final Report shall be submitted to the Building Official and the Engineer at the time agreed upon by the Owner and the Building Official.

Frequency of Interim Report submittals to the Building Official:

___ Weekly ___ Bi-Weekly X Monthly Other; specify:_____

Frequency of Interim Report submittals to the Engineer:

___ Weekly ___ Bi-Weekly X Monthly Other; specify:_____

Special Inspections do not relieve the Contractor of the obligation to comply with the Contract Documents. Jobsite safety and means and methods of construction are solely the responsibility of the Contractor.

Registered Design Professional's Seal

Statement of Special Inspections Prepared by:

_____
Type or print name

_____
Signature Date

Building Official's Acceptance:

_____
Type or print name

_____
Signature Date

SECTION 01 51 00

TEMPORARY UTILITIES

PART 1 – GENERAL

1.01 SUMMARY

A. Contractor shall provide temporary utilities required for the Project and to complete the Work.

1. Make arrangements with utility service companies for temporary services and obtain required permits and approvals for temporary utilities.

2. Pay utility service costs, including connection fees, required for the Work as needed.

3. Continuously maintain adequate utilities for all purposes during the Project, until removal of temporary utilities and temporary facilities. At minimum, provide and maintain temporary utilities through Substantial Completion and removal of temporary field offices and sheds.

4. Should Owner occupy part of the Project prior to Substantial Completion of the entire Work, cost of utilities consumed via temporary utilities serving the portion occupied by Owner will be shared proportionately between Owner and Contractor as mutually agreed to by the parties.

5. Maintain, including cleaning, temporary utilities and continuously provide consumables as required.

6. Temporary utilities and temporary facilities shall be adequate for personnel using the Site and requirements of Project.

7. Provide temporary utilities and temporary facilities in compliance with Laws and Regulations and, when applicable, requirements of utility owners.

B. Provide the following temporary utilities at minimum:

1. Electricity and lighting.

2. Telephone and communications.

3. Heating.

4. Sanitary facilities.

5. Water service.

6. First-aid facilities.

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7. Fire protection.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Use of Owner's System:

1. Existing Utility Systems: Do not use systems in existing buildings or structures for temporary utilities without Owner's written permission and mutually acceptable basis agreed upon by the parties for proportionate sharing of costs between Owner and Contractor.

2. Use of Permanent Utility Systems Provided Under the Project:

a. Permanent lighting, water, heating, ventilating, and fire protection systems and first-aid facilities may be used to provide temporary utilities and temporary facilities if the following are met:

1) Obtain Owner's written permission to use permanent systems.

2) Permanent systems to be used for temporary utilities or temporary facilities shall have achieved Substantial Completion, including complete functionality of all controls.

3) Contractor shall pay all costs while using permanent system, including operation, maintenance, replacement of consumables, and provide replacement parts.

b. Do not use the following permanent facilities:

1) Telephone and communication facilities.

2) Sanitary facilities.

1.03 SYSTEM DESCRIPTION

A. Electricity and lighting:

1. Contractor shall provide electrical and lighting service for construction field offices, sheds, storage containers, etc. and as required for the Work.

2. General 120/240 V service requirements:

a. Contractor shall provide 120/240 V, single phase, 3-wire temporary system for small power requirements and general lighting.

b. Contractor shall provide main disconnect, overcurrent protection, meter outlet, branch circuit breakers, and wiring for temporary service to the Contractor's field office service connections. Contractor shall provide

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equipment and appurtenances in accordance with electricity service provider and applicable standards and codes

c. Contractor shall register the 120/240 V electrical service meter in the Contractor's name and shall be responsible for electrical charges at no additional cost to the Owner.

d. Contractor shall provide electrical service other than 120/240 V, single phase, 3-wire service as required for the Work at the Contractor's own expense.

3. General lighting requirements:

a. Contractor shall provide a minimum of 10 foot candles for enclosed and partially enclosed structures for performing the Work.

b. Contractor shall provide a night lighting circuit for security. Light intensity shall be a minimum of 2 foot candles.

4. Contractor shall energize the electrical system 15-minutes prior to and following regular work day hours at the Site. Required from Monday through Friday, all inclusive.

5. Contractor shall energize the night lighting system at end of typical working day and de-energize at start of typical working day. System shall be continuously energized on Saturdays, Sundays, and holidays.

6. Contractor shall provide an independent grounding cable connected directly to the structure, building, and equipment for erection and fabrication by electrical welders. Grounding by adjacent conduit, piping, etc. shall be prohibited at the Site.

7. Contractor shall coordinate usage of temporary electrical system with Subcontractors, Suppliers, and Owner including the following:

a. Usage is suitable for 120V, single phase, 60 Hz operation with a maximum operating input of 1,500 volt-amperes.

b. One unit connected to a single outlet.

c. Restrict usage in case of overloading circuits to correct loading.

B. Telephone and communications: Contractor shall provide temporary telephone and communications required for its operations at the Site and for summoning emergency medical assistance.

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C. Heating:

1. Contractor shall provide temporary heating, ventilation coverings and enclosures necessary to protect the Work and materials against wetness and temperature damage, to dry out the Work, and to facilitate the Work in structures.

2. Equipment, fuel, materials, personnel and methods used shall be adequate to maintain critical installation temperatures and ventilation of Work at all times in areas where necessary to perform the Work.

3. Enclosed structures shall have a minimum temperature of 50°F, unless otherwise specified, where Work is performed.

4. Contractor shall provide sufficient heat to maintain a minimum temperature of 65°F before and during application of interior finishing, painting, coating, etc.

5. Contractor shall replace any Work damaged by dampness or insufficient/abnormal heating at no cost to the Owner.

D. Sanitary facilities:

1. Contractor shall provide suitably-enclosed chemical or self-contained toilets for Contractor's employees and visitors to the Site. Location of temporary toilets shall be acceptable to Owner and screened from public observation.

2. Facilities shall be maintained and provided in accordance with State Labor Regulations and local ordinances. Contents shall be removed and disposed in accordance with local and state regulations as required.

3. Contractor shall be prohibited from committing nuisances within, on, or in the vicinity of the Site.

E. Water service:

1. Contractor shall provide temporary water service for the Work including for construction purposes, sanitary facilities, fire protection, field office, and cleaning purposes.

2. Contractor shall provide potable water for Contractor's personnel either by portable containers or drinking fountains.

3. Contractor shall provide temporary hose bibs, hoses, and watertight barrels for the distribution of water.

4. Contractor shall provide freeze protection for water service.

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F. First-aid facilities:

1. Contractor shall provide temporary first-aid stations at or immediately adjacent to the Site's major work areas. Contractor shall provide temporary first-aid stations inside its temporary field office. Locations of first-aid stations shall be determined by Contractor's safety representative.

2. Contractor shall provide list of emergency telephone numbers at each hardwired telephone at the Site. List shall be in accordance with the list of emergency contact information required in Section 01 31 19 – Project Meetings.

G. Fire protection:

1. Contractor shall comply with NFPA 241, Safeguarding Building Construction, Alteration, and Demolition Operations, and requirements of fire marshals and authorities having jurisdiction at the Site.

2. Contractor shall provide temporary fire exits, fire extinguishers, hoses and safety devices as required by authorities having jurisdiction.

3. Contractor shall notify Engineer, Owner, and fire marshals in the event of fire at the Site including, but not limited to, fuel tanks and similar hazardous utilities and devices. Contractor shall cooperate with Owner of fuel tank and utilities to prevent occurrence of fire or explosion.

4. Contractor shall perform safety precautions and comply with fire marshal's instructions in the event of fire.

PART 2 – PRODUCTS

2.01 EQUIPMENT

A. Materials and equipment for temporary systems may be new or used but shall be adequate for purposes intended and shall not create unsafe conditions and shall comply with Laws and Regulations.

B. Provide required materials, equipment, and facilities, including piping, wiring, and controls.

C. Electrical system requirements: System shall consist of wiring, switches, insulated supports, poles, fixtures, sockets, receptacles, lamps, guards, cutouts and fuses as required for completion of the Work.

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PART 3 – EXECUTION

3.01 INSTALLATION

A. Install temporary facilities in neat, orderly, manner, and make structurally, mechanically, and electrically sound throughout.

B. Location of Temporary Utilities and Temporary Facilities:

1. Locate temporary systems for proper function and service.

2. Temporary systems shall not interfere with or provide hazards or nuisances to: the Work under this and other contracts, movement of personnel, traffic areas, materials handling, hoisting systems, storage areas, finishes, and work of utility companies.

3. Do not install temporary utilities on the ground, with the exception of temporary extension cords, hoses, and similar systems in place for short durations.

C. Modify and extend temporary systems as required by progress of the Work.

3.02 MAINTENANCE

A. Maintain temporary systems to provide safe, continuous service as required.

B. Properly supervise operation of temporary systems:

1. Enforce compliance with Laws and Regulations.

2. Enforce safe practices.

3. Prevent abuse of services.

4. Prevent nuisances and hazards caused by temporary systems and their use.

5. Prevent damage to finishes.

6. Ensure that temporary systems and equipment do not interrupt continuous progress of construction.

C. At end of each work day, check temporary systems and verify that sufficient consumables are available to maintain operation until work is resumed at the Site. Provide additional consumables if the supply on hand is insufficient.

D. Contractor shall replace broken and burned out lamps, blown fuses, and damaged wiring and appurtenances as required to maintain adequate and safe operating conditions.

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E. Contractor shall permit subcontractors and others at a mutually agreed arrangement to use temporary electrical system that meet the following requirements:

1. Equipment are suitable for 120 V, single phase, 60 Hz operation.

2. Operating input does not exceed 1,500 volt-amperes.

3. Single piece of equipment connected to one outlet.

4. Contractor shall restrict use of equipment as required to prevent overloading circuits.

3.03 CLOSEOUT ACTIVITIES

A. Completely remove temporary utilities, facilities, equipment, and materials when no longer required. Repair damage caused by temporary systems and their removal and restore the Site to condition required by the Contract Documents; if restoration of damaged areas is not specified, restore to preconstruction condition.

B. Contractor is responsible for and shall return to original condition those portions of permanent electric system used in completing the Work.

C. Where temporary utilities are disconnected from existing utility, provide suitable, watertight or gastight (as applicable) cap or blind flange, as applicable, on service line, in accordance with requirements of utility owner.

D. When permanent utilities and systems that were used for temporary utilities, upon Substantial Completion replace all consumables such as filters and light bulbs and parts used during the Work.

END OF SECTION

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NO TEXT ON THIS PAGE

SECTION 01 52 00
CONSTRUCTION FACILITIES

PART 1 – GENERAL

1.01 SUMMARY

A. Contractor shall provide construction facilities for performance of the Work, including the following:

1. Contractor's field office, sheds, and storage containers that shall be erected within 30 days of Notice to Proceed on the Project.

2. Related Sections:

a. Section 01 51 00 – Temporary Utilities

1.02 FACILITY DESCRIPTION

A. Contractor's Field Office, Sheds, and Storage:

1. Contractor shall provide and maintain a field office at the Site, including temporary utility services specified.

2. Size and Furnishings: As required by Contractor

3. Features: Exterior Contractor identification sign, night lighting for security, and temporary utilities specified in Section 01 51 00 – Temporary Utilities.

4. Location: As determined during the Pre-Construction Meeting and as approved by the Engineer and Owner.

5. Contractor shall provide and maintain one set of Contract Documents, latest approved Shop Drawings, Field Orders, request for interpretations, clarification notices, Work Change Directives, proposal requests, Change Proposals, Change Orders, and other pertinent Project related correspondence.

1.03 SUBMITTALS

A. Action/Informational Submittals:

1. Contractor shall submit proposed location of Contractor's Field Office, Sheds, and Storage to the Engineer for approval.

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PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 55 00
CONTRACTOR ACCESS AND PARKING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Contractor shall provide and maintain temporary laydown and employee parking areas and appurtenances required during the Project for use by Contractor, other contractors employed on the Project, Owner's, and emergency vehicles, as directed by the Owner and the Engineer.

2. Laydown and employee parking areas shall be designed and maintained by Contractor and shall be fully passable to vehicles in all weather conditions.

3. Contractor shall submit proposed locations of temporary laydown and employee parking areas and appurtenances required during the Project to the Engineer and Owner for approval before installation.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Access roads:

1. Contractor shall construct and maintain such temporary access roads as required to perform the Work.

2. Contractor shall construct access roads, where possible, in locations over the areas of future road systems.

3. Access roads shall be located within the property lines of the Owner unless the Contractor independently secures easements for use and convenience.

a. Contractor shall submit written documentation to the Engineer for Contractor secured easements across privately held property.

b. Easement agreements shall specify terms and conditions of use and provisions for Site restoration.

c. Written release from property owner certifying that terms of the easement agreement have been complied by the Contractor shall be furnished to the Engineer prior to final payment.

B. Use of existing access roads:

1. Contractor will be allowed to use Owner's existing roads upon approval by the Owner.

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2. Prevent interference with traffic on existing roads and parking areas. At all times, keep access roads and entrances serving the Site clear and available to Owner, Owner's employees, emergency vehicles, and other contractors. Do not use access roads or Site entrances for parking or storage of materials or equipment.

3. Contractor shall indemnify and hold harmless Owner and Engineer from expenses caused by Contractor's operations over existing roads and parking areas.

4. Schedule deliveries to minimize use of driveways and Site entrances.

5. Contractor shall suitably maintain existing access road at Contractor's expense for the duration of the Contract time.

C. Contractor parking areas:

1. Contractor employee vehicles shall park in area(s) designated by Owner.

2. Contractor shall construct and maintain parking area at the Site.

D. State and local regulations:

1. Contractor shall obtain and pay all cost associated with bonds required by authorized entity (i.e., State Department of Transportation) for the use of State maintained roads.

2. Contractors shall obey traffic laws and comply with requirements, rules and regulations of the authorized entity (i.e., State Department of Transportation), including local authorities having jurisdiction, to maintain warning signs, lights, barriers, etc. for the protection of traffic on public roadways.

E. Site security:

1. Contractor shall safely guard all the Work, the Project, products, equipment, and property from loss, theft, damage, and vandalism until Substantial Completion. Contractor's duty includes safely guarding Owner's property in vicinity of the Work and Project, and other private property in the vicinity of the Project from injury and loss in connection with performance of the Project.

2. Employ watchmen as required to provide required security and prevent unauthorized entry.

3. Costs for security required under this Section shall be paid by Contractor.

4. Make no claim against Owner for damage resulting from trespass.

5. Pay full compensation for, or repair or replace, damage to property of Owner and others arising from failure to furnish adequate security.

6. Provide temporary fencing in accordance with the Contract Documents.

7. Security requirements specified in the Section shall begin as soon as the contractor delivers materials to the Site and/or begins work and shall continue until the date of Final Completion.

8. Procedures:

    a. Contractor shall conform to Owner's security procedures and access restrictions at Site throughout entire Project.

    b. Contractor, including Subcontractors and Suppliers, shall comply with the following:

        1) Personnel Identification: All Contractor personnel shall wear at all times on-Site a badge bearing Contractor's name, employee's name and, as applicable, employee number.

        2) Parking: Do not park outside of designated Contractor parking area, as determined by the Owner. Prepare and maintain parking area as required. Personal vehicles are not allowed outside Contractor parking area.

9. Contractor shall provide and maintain temporary security fencing if existing security fencing or barriers are breached or temporarily removed for the Project at no additional cost to the Owner. Temporary security fencing shall be equal to existing, unless otherwise specified, and provided and maintained in a manner satisfactory to Engineer and Owner.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 INSTALLATION

A. Contractor shall determine if and where temporary fencing is necessary, unless existing security fencing is damaged, which will be determined by Engineer and Owner.

B. Install temporary fencing used for site security in accordance with the Contract Documents and fence manufacturer's instructions. Provide temporary fencing for site security so that integrity of site security is maintained throughout the Project.

C. Maintain temporary fencing. Repair damage to temporary fencing and replace fencing when required to maintain site security.

D. Remove temporary fencing when permanent site security fencing is in place and fully functional, or when otherwise directed by Owner or Engineer.

END OF SECTION

SECTION 01 57 00
TEMPORARY CONTROLS

PART 1 – GENERAL

1.01 SUMMARY

A. Contractor shall provide and maintain methods, equipment, and temporary construction as required to control environmental conditions at the Site and adjacent areas.

B. Maintain controls until no longer required.

C. Temporary controls include, but are not limited to, the following:

1. Dust control.

2. Noise controls.

3. Pest and rodent control.

4. Pollution control.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 DUST CONTROL

A. Contractor shall take measures to control dust from Contractor's operations and prevent spillage of excavated materials on public roads.

B. Contractor shall remove spillage of excavated materials, debris and dust from public roads by methods approved by Engineer.

C. Contractor shall provide temporary dust-proof partitions where required to protect unaltered portions of existing structures and facilities and as directed by Engineer or Owner. Temporary partitions shall be provided where demolition Work is required, to protect equipment and material, and shall consist of the following:

1. Wood studs with plywood on both sides and extend from floor to ceiling.

2. Closure plate at floor and ceiling.

3. One door (minimum) with hardware.

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D. Contractor shall refer to applicable sections of local and state regulations on dust control for additional guidance.

1. Contractor shall apply water at locations, quantities, and frequencies required by Engineer to control dust for nuisance prevention to Owner, Engineer, and properties in the vicinity of the Site.

2. Dust control and cleaning measures shall be provided at no additional cost to the Owner.

3.02 NOISE CONTROL

A. Contractor's vehicles and equipment shall minimize noise emissions to greatest degree practicable. Provide mufflers, silencers, and sound barriers when necessary.

B. Noise levels shall comply with Laws and Regulations, including OSHA requirements and local ordinances.

C. Noise emissions shall not interfere with the work of Owner or others.

3.03 PEST AND RODENT CONTROL

A. Provide rodent and pest control as required to prevent infestation of the Site and storage areas.

B. Employ methods and use materials that do not adversely affect conditions at the Site or on adjoining properties.

C. In accordance with laws and regulations, promptly and properly dispose of pests and rodents trapped or otherwise controlled.

3.04 POLLUTION CONTROL

A. General:

1. Provide means, methods, and facilities required to prevent contamination of soil, water, and atmosphere caused by discharge of noxious substances from construction operations.

2. Equipment used during construction shall comply with Laws and Regulations.

B. Spills and Contamination:

1. Provide equipment and personnel to perform emergency measures required to contain spills and to remove contaminated soils and liquids.

2. Excavate contaminated material and properly dispose of off-site, and replace with suitable compacted fill and topsoil.

C. Protection of Surface Waters: Implement special measures to prevent harmful substances from entering surface waters. Prevent disposal of wastes, effluents,

chemicals, and other such substances in or adjacent to surface waters and open drainage routes, in sanitary sewers, or in storm sewers.

D. Atmospheric Pollutants:

1. Provide systems for controlling atmospheric pollutants related to the Work.

2. Prevent toxic concentrations of chemicals and vapors.

3. Prevent harmful dispersal of pollutants into atmosphere.

E. Solid Waste:

1. Provide systems for controlling and managing solid waste related to the Work.

2. Prevent solid waste from becoming airborne, and from discharging to surface waters and drainage routes.

3. Properly handle and dispose of solid waste.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 01 61 00
PRODUCT REQUIREMENTS AND OPTIONS

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Common requirements for products.

2. Contractor's options for selecting products.

3. Requirements for consideration of "or equal" products.

4. Warranty requirements of products.

1.02 REFERENCES

A. Definitions:

1. "Products" includes materials, equipment, machinery, components, fixtures, systems, and other goods incorporated in the Work. Products do not include machinery and equipment used for preparing, fabricating, conveying, erecting, or installing the Work. Products include Owner-furnished goods incorporated in the Work where use of such goods is specifically required in the Contract Documents.

2. "Special Warranties" includes additions or modifications to standard warranty requirements specified in the Contract Documents.

1.03 SUBMITTALS

A. Warranty Log Book:

1. Submit warranty log book prepared specifically for this Project. Submittal shall include a summary listing of all equipment and material warranties furnished in the Contract, date received, and start/end date of warranty period. Individual warranty documentation shall be provided in the submittal.

2. Submit prior to submittal of final application for payment.

B. Patent Documentation: Submit licensing arrangement and agreement documentation.

1.04 REQUIREMENT

A. Common Products:

1. Provide products that have not been previously incorporated into another project or facility unless otherwise indicated in the Contract Documents.

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2. Provide products of the same generic kind from a single source.

3. Provide products complete with accessories, trim, finish, fasteners, and other items shown, indicated, or required for a complete installation for the indicated use and performance.

4. Standard Products: When available, and unless custom or nonstandard options are specified or indicated, provide standard products of types that have been produced and used successfully in similar situations on other projects.

5. Visual Matching: Where required in the Contract Documents, provide products that match referenced existing construction, approved mock-ups, or approved Sample, as determined by Engineer.

6. Where the Contract Documents include the phrase “as selected” for product color, finish pattern, option, or similar phrase, provide products selected by Engineer as follows:

   a. Standard Range: Where the Contract Documents include the phrase “standard range of colors, patterns, textures” or similar phrase, provide color, pattern, density, or texture selected by Engineer from manufacturer’s product line that does not include premium items.

   b. Full Range: Where the Contract Documents include the phrase “full range of colors, patterns, textures” or similar phrase, Engineer will select color, pattern, density, or texture from manufacturer’s entire product line, including standard and premium items.

B. Product Compatibility:

1. Similar products by the same Supplier shall be compatible with each other, unless otherwise indicated in the Contract Documents.

2. Provide products compatible with products previously selected or installed on the Project.

C. Product Options:

1. For products specified only by reference standard or description, without reference to Supplier, provide products meeting that standard, by a Supplier or from a source that complies with the Contract Documents.

2. For products specified by naming one or more products or Suppliers, provide the named products that comply with the Contract Documents, unless an “or equal” or substitute product is approved by Engineer.

3. For products specified by naming one or more products or Suppliers and the term, “or equal”, when Contractor proposes a product or Supplier as an “or equal”, submit to Engineer a request for approval of an “or equal” product or Supplier.

4. For products specified by naming only one product or manufacturer and followed by words indicating that no substitution is allowed, there is no option and no substitution will be allowed.

D. Concerning Patents:

1. Owner shall be provided a guarantee by Contractor and equipment Supplier that equipment and material furnished in accordance with the Contract Documents is not the subject of patent litigation.

2. Patent litigation or controversy shall include, but not limited to, the following:

a. Actual furnished equipment and material the is subject or could be subject to patent litigation or is known to infringe on a patent.

b. Furnished equipment and material that may result in a process that use of equipment and material in a manner that infringes upon or violates a patent.

3. When patent infringement may occur, Contractor and Supplier shall submit license arrangements among parties, including Contractor, Supplier, and patent owner (controller of patent) at a minimum, which shall permit use of equipment and material as specified in the Contract Documents.

4. Supplier shall indemnify and hold harmless Owner and Engineer against all claims, costs, losses, and damages arising out of or relating to any infringement or patent rights or copyrights incident to the use of equipment and material specified in the Contract Documents and as required in General Contract Conditions and as modified in the Special Contract Conditions.

E. “Or Equal” Products:

1. For proposed products not named in the Contract Documents and considered as an “or equal” as defined in the General Contract Conditions, Contractor shall request in writing Engineer’s approval of the “or equal”. Request for approval of an “or equal” product shall accompany the Shop Drawing or product data submittal for the proposed product and shall include:

a. Contractor’s request that the proposed product be considered as an “or equal” in accordance with the General Contract Conditions, accompanied by Contractor’s certifications required in the General Contract Conditions.

b. Documentation adequate to demonstrate that proposed product does not require revisions to the Contract Documents, that proposed product is

consistent with the Contract Documents, and that proposed product will produce results and performance required in the Contract Documents, and that proposed product is compatible with other portions of the Work.

c. Detailed comparison of significant qualities of proposed product with the products and manufacturers named in the Contract Documents. Significant qualities include attributes such as performance, weight, size, durability, visual effect, performance and specific features and requirements shown or indicated.

d. Evidence that proposed product manufacturer will furnish warranty equal to or better than specified, if any.

e. List of similar installations for completed projects with project names and physical addresses of installation along with the names, telephone numbers, email addresses and physical address of design professionals and owners associated with the referenced installation, if requested.

f. Samples, if requested.

g. Other information requested by Engineer.

1.05 WARRANTY

A. Warranties specified for products shall be in addition to, and run concurrent with, Contractor's general warranty and guarantee and requirements for the required correction period. Disclaimers and limitations in specific product warranties do not limit Contractor's general warranty and guarantee.

1. Product manufacturer's warranty is preprinted written warranty published by product manufacturer and specifically endorsed by product manufacturer to Owner.

2. Equipment and material shall be guaranteed to be free from defects in workmanship, design, and/or materials for a period of one (1) year unless otherwise specified in the individual Specification Section for a Special Warranty.

3. Warranty period shall start on the date of the particular equipment and material is substantially complete, which includes requirements specified in Section 01 75 00 – Checkout and Startup Procedures for start-up certification and specified elsewhere in the Contract Documents.

4. Warranty requirements may be added to or modified in the individual Specification Sections. Special warranty is written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by product manufacturer's warranty or to provide increased rights to Owner.

5. Special warranty information, if any, will be located in the Specification Section for that product.

B. Requirements for Special Warranties: Provide written special warranty document that contains appropriate terms and identification, ready for execution by product manufacturer and Owner. Submit draft warranty with submittals required for product.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed by product manufacturer and other parties as appropriate.

2. Specified Form: When specified forms are included in the Contract Documents, prepare written document, properly executed by product manufacturer and Owner, using appropriate form.

3. Refer to Specifications for content and requirements for submitting special warranties.

C. Submit product manufacturer's warranties and special warranties as submittals in accordance with Schedule of Submittals accepted by Engineer.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 01 65 00
PRODUCT DELIVERY REQUIREMENTS

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. General requirements for preparing for shipping, delivering, and handling materials and equipment.

2. Contractor shall make all arrangements for transporting, delivering, and handling of materials and equipment required for prosecution and completion of the Work.

1.02 SUBMITTALS

A. Refer to individual Specification Sections for submittal requirements relative to delivery and handling materials and equipment.

1.03 SHIPMENT REQUIREMENTS

A. When practical, factory-assemble materials and equipment. Match mark or tag separate parts and assemblies to facilitate field assembly. Cover machined and unpainted parts that may be damaged by the elements with strippable, protective coating.

B. Package materials and equipment to facilitate handling, and protect materials and equipment from damage during shipping, handling, and storage. Mark or tag outside of each package or crate to indicate the associated purchase order number, bill of lading number, contents by name, Owner's contract name and number, Contractor name, equipment number, and approximate weight. Include complete packing lists and bills of materials with each shipment.

C. Protect materials and equipment from exposure to the elements and keep thoroughly dry and dust-free at all times. Protect painted surfaces against impact, abrasion, discoloration, and other damage. Lubricate bearings and other items requiring lubrication in accordance with manufacturer's instructions.

D. Advance Notice of Shipments:

1. Keep Engineer informed of delivery of all materials and equipment to be incorporated in the Work.

E. Do not ship materials and equipment until:

1. Related Shop Drawings, Samples, and other submittals have been approved or accepted (as applicable) by Engineer, including, but not necessarily limited to, Submittals associated with the materials and equipment being delivered.

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2. Manufacturer's instructions for handling, storing, and installing the associated materials and equipment have been submitted to and accepted by Engineer in accordance with the Specifications.

3. Results of source quality control testing (factory testing), when required by the Contract Documents for the associated materials or equipment, have been reviewed and accepted by Engineer.

4. Facilities required for handling materials and equipment in accordance with manufacturer's instructions are in place and available.

5. Required storage facilities have been provided.

1.04 DELIVERY REQUIREMENTS

A. Scheduling and Timing of Deliveries:

1. Arrange deliveries of materials and equipment in accordance with the accepted Progress Schedule and in ample time to facilitate inspection prior to installation.

   a. Equipment and material shall not be delivered to the Site prior to 90 days in advance of scheduled installation.

   b. Partial payment requests will not be processed for materials delivered prior to 90 days before installation or for materials that are improperly stored.

2. Schedule deliveries to minimize space required for and duration of storage of materials and equipment at the Site or delivery location, as applicable.

3. Coordinate deliveries to avoid conflicting with the Work and conditions at Site, and to accommodate the following:

   a. Work of other contractors and Owner.

   b. Owner's operations and maintenance.

   c. Storage space limitations.

   d. Availability of equipment and personnel for handling materials and equipment.

   e. Owner's use of premises.

4. Deliver materials and equipment to the Site during regular working hours.

5. Deliver materials and equipment to avoid delaying the Work and the Project, including work of other contractors, as applicable. Deliver anchor system

materials, including anchor bolts to be embedded in concrete or masonry, in ample time to avoid delaying the Work.

B. Deliveries:

1. Shipments shall be delivered with Contractor's name, Subcontractor's name (if applicable), Site name, Project name, and contract designation clearly marked.

2. Site may be listed as the "ship to" or "delivery" address; but Owner shall not be listed as recipient of shipment unless otherwise directed in writing by Engineer.

3. Provide Contractor's telephone number to shipper; do not provide Owner's telephone number.

4. Arrange for deliveries while Contractor's personnel are at the Site. Contractor shall receive and coordinate shipments upon delivery. Shipments delivered to the Site when Contractor is not present will be refused by Owner, and Contractor shall be responsible for the associated delays and additional costs, if incurred.

C. Containers and Marking:

1. Have materials and equipment delivered in manufacturer's original, unopened, labeled containers.

2. Clearly mark partial deliveries of component parts of materials and equipment to identify materials and equipment, to allow easy accumulation of parts, and to facilitate assembly.

D. Inspection of Deliveries:

1. Immediately upon delivery, Contractor shall inspect shipment to verify that:

a. Materials and equipment comply with the Contract Documents and approved or accepted (as applicable) submittals.

b. Quantities are correct.

c. Materials and equipment are undamaged.

d. Containers and packages are intact and labels are legible.

e. Materials and equipment are properly protected.

2. Promptly remove damaged materials and equipment from the Site and expedite delivery of new, undamaged materials and equipment, and remedy incomplete or lost materials and equipment to furnish materials and equipment in accordance with the Contract Documents, to avoid delaying progress of the Work.

3. Advise Engineer in writing when damaged, incomplete, or defective materials and equipment are delivered, and advise Engineer of the associated impact on the Progress Schedule.

1.05 HANDLING REQUIREMENTS

A. Provide equipment and personnel necessary to handle materials and equipment, including those furnished by Owner, by methods that prevent soiling or damaging materials and equipment and packaging.

B. Provide additional protection during handling as necessary to prevent scraping, marring, and otherwise damaging materials and equipment and surrounding surfaces.

C. Handle materials and equipment by methods that prevent bending and overstressing.

D. Lift heavy components only at designated lifting points.

E. Handle materials and equipment in safe manner and as recommended by the manufacturer to prevent damage. Do not drop, roll, or skid materials and equipment off delivery vehicles or at other times during handling. Hand-carry or use suitable handling equipment.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 66 00
PRODUCT STORAGE AND PROTECTION REQUIREMENTS

PART 1 – GENERAL

1.01 SUMMARY

A. General requirements of storing and protecting equipment and materials.

1.02 STORAGE

A. Store and protect materials and equipment in accordance with manufacturer's recommendations and the Contract Documents.

B. Contractor shall make all arrangements and provisions necessary for, and pay all costs for, storing materials and equipment. Construction equipment, and materials and equipment to be incorporated into the Work shall be placed to avoid injuring the Work and existing facilities and property, and so that free access is maintained at all times to all parts of the Work and to public utility installations in vicinity of the Work. Store materials and equipment neatly and compactly in locations that cause minimum inconvenience to Owner, other contractors, public travel, and owners, tenants, and occupants of adjoining property. Arrange storage in manner to allow easy access for inspection.

C. Areas available at the Site for storing materials and equipment will be determined by the Owner.

D. Store materials and equipment to become Owner's property to facilitate their inspection and ensure preservation of quality and fitness of the Work, including proper protection against damage by freezing, moisture, and high ambient temperatures. Store in indoor, climate-controlled storage areas all materials and equipment subject to damage by moisture, humidity, heat, cold, and other elements, unless otherwise acceptable to Owner.

E. Contractor shall be fully responsible for loss or damage (including theft) to stored materials and equipment.

F. Do not open manufacturer's containers until time of installation, unless recommended by the manufacturer, directed by Engineer or otherwise specified in the Contract Documents.

G. Do not store materials or equipment in structures being constructed unless approved by Engineer in writing.

H. Do not use lawns or other private property for storage without written permission of the owner or other person in possession or control of such premises.

I. Contractor shall not store unnecessary equipment and materials at the Site.

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J. Contractor shall prevent structures from being loaded with a weight that endanger its security and/or safety of persons.

K. Stored equipment and materials shall not be placed within 10 feet of fire hydrants.

L. Gutters, drainage channels and inlets shall be kept unobstructed at all times.

1.03 PROTECTION

A. Contractor shall provide temporary storage containers/facilities, if required, to protect equipment and materials at the Site.

B. Equipment to be incorporated into the Work shall be boxed, crated, or otherwise completely enclosed and protected during shipping, handling, and storage, in accordance with Section 01 65 00 – Product Delivery Requirements.

C. Store all materials and equipment off the ground (or floor) on raised supports such as skids or pallets.

D. Protect painted surfaces against impact, abrasion, discoloration, and other damage. Painted equipment surfaces that are damaged or marred shall be repainted in their entirety in accordance with equipment manufacturer and paint manufacturer requirements, to the satisfaction of Engineer.

1.04 SPECIFIC STORAGE REQUIREMENTS

A. Uncovered:

1. The following types of materials may be stored outdoors without cover on supports so there is no contact with the ground:

    a. Piping, except polyvinyl chloride (PVC) or chlorinated PVC (CPVC) pipe.

B. Covered:

1. The following materials and equipment may be stored outdoors on supports and completely covered with covering impervious to water:

    a. Grout and mortar materials.

    b. Rough lumber.

    c. PVC and CPVC pipe.

2. Tie down covers with rope, and slope covering to prevent accumulation of water.

C. Fully Protected:

1. All materials and equipment not named as uncovered or covered in this Section, shall be stored on supports in buildings or trailers that have concrete or wooden flooring, roof, and fully closed walls on all sides. Covering with plastic sheeting or similar material in space without floor, roof, and walls is not acceptable. Comply with the following:

    a. Provide heated storage for materials and equipment that could be damaged by low temperatures or freezing.

    b. Provide air-conditioned storage for materials and equipment that could be damaged by high temperatures.

    c. Protect mechanical and electrical equipment from being contaminated by dust, dirt, and moisture.

    d. Maintain humidity at levels recommended by manufacturers of electrical and electronic equipment.

    e. Energize space heaters fore electrical equipment and material.

D. Maintenance of Storage: On scheduled basis, periodically inspect stored materials and equipment to ensure that:

1. Condition and status of storage facilities is adequate to provide required storage conditions.

2. Required environmental conditions are maintained on continuing basis.

3. Materials and equipment exposed to elements are not adversely affected.

1.05 RECORDS

A. Keep up-to-date account of materials and equipment in storage to facilitate preparation of Applications for Payment, if the Contract Documents provide for payment for materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 71 23

FIELD ENGINEERING

PART 1 – GENERAL

1.01 SUMMARY

A. Contractor shall provide field engineering and professional services of the types indicated for the Project, including:

1. Furnishing civil, structural, and other professional engineering services specified or required to execute Contractor's construction methods.

2. Developing and making all detail surveys and measurements required for construction.

3. Keeping a transit, theodolite, or total station (theodolite with electronic distance measurement device); leveling instrument; and related implements such as survey rods and other measurement devices, at the Site at all times, and having a skilled instrument person available when necessary for laying out the Work.

4. Being solely responsible for all locations, dimensions and levels. No data other than Change Order, Work Change Directive, or Field Order shall justify departure from dimensions and levels required by the Contract Documents.

5. Rectifying all Work improperly installed because of not maintaining, not protecting, or removing without authorization established reference points, stakes, marks, and monuments.

6. Providing such facilities and assistance necessary for Engineer to check lines and grade points placed by Contractor.

B. Related Sections:

1. Section 01 25 00 – Substitution Procedures

2. Section 01 26 00 – Contract Modification Procedures

3. Section 01 61 00 – Product Requirements and Options

4. Section 01 78 39 – Project Record Documents

1.02 ADMINISTRATIVE REQUIREMENTS

A. Departures from Contract Drawings:

1. Contract Drawings show the extent and arrangement of the Work.

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2. Contractor shall notify Engineer of departures from the Drawings that the Contractor deems required for incorporation of the Work at the Site in accordance with Section 01 26 00 – Contract Modification Procedures.

3. Contractor shall provide field engineering services for equipment and materials that require modifications to existing structures, auxiliary equipment, piping, electrical controls that are not indicated for modifications in the Contract Documents.

B. Structural Design Criteria:

1. Structural design in the Contract Documents of facilities, structures, supports, roofs and floors are based on typical weights for equipment and materials and design criteria in the Contract Documents.

2. Contractor shall notify Engineer of equipment and materials to be considered as substitutions and “or equals” in accordance with Section 01 25 00 – Substitution Procedures and Section 01 61 00 – Product Requirements and Options.

3. Contractor shall provide services for incorporation of equipment and materials that exceed structural design criteria at no additional cost to Owner.

1.03 SERVICES AND RESPONSIBILITIES

A. Contractor’s Field Engineer:

1. Contractor shall employ and retain field engineer at the Site capable of performing field engineering tasks required, including:

a. Provide reports to Engineer on the Work.

b. Check formwork, reinforcing, inserts, structural steel, bolts, sleeves, piping and other equipment and materials for conformance with Contract Documents.

c. Maintain field office files and drawings, record documents, and coordination with Subcontractors.

d. Prepare layout and coordination drawings for construction operations.

e. Check and coordinate Work for conflicts, interferences, and discrepancies with notification to Engineer.

f. Cooperate with Engineer and Owner in observing the Work and field inspections.

g. Review and coordinate the Work with Shop Drawings and other submittals.

B. Contractor’s Surveyor:

1. Contractor shall employ or retain the services, as needed, at the Site a surveyor with experience and capability of performing surveying and layout tasks required in the Contract Documents and as required for the Work. Surveyor's tasks include, but are not necessarily limited to, the following:

a. Providing required surveying equipment, including transit or theodolite, level, stakes, and surveying accessories.

b. Establishing required lines for constructing all facilities, structures, pipelines, and site improvements.

c. Preparing and maintaining professional-quality, accurate, well organized, legible notes of all measurements and calculations made while surveying and laying out the Work.

d. Complying with requirements of the Contract Documents relative to surveying and related work.

1.04 SUBMITTALS

A. Action/Informational Submittals:

1. Surveying:

a. Plan for conducting survey Work, submitted ten days prior to beginning of survey Work.

b. Field books after completing survey Work.

c. Certified survey in accordance with this Section.

2. Certificates: Signed Contractor or Contractor’s surveyor certifying elevations and locations of Work are in conformance with Contract Documents, with explanations of deviations.

3. Qualification Statements: Contractor’s surveyor.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 SURVEYING

A. Contractor shall establish baselines for location of equipment, materials and structures of the Work with bench marks and batter boards adjacent to Work.

B. Contractor shall provide detailed surveys necessary for the Work including, but not limited to, slope stakes, batter boards, working points, lines and elevations.

C. Specific surveying:

1. Contractor shall have weirs surveyed by professional, licensed surveyor.

2. Contractor shall adjust weirs within a tolerance of +/- 0.05-inches of elevations shown on the Contract Documents.

3. Surveyed points for weirs shall be no greater than 10-feet spacing, and no less than two points per section of weir plate.

3.02 CLOSEOUT ACTIVITIES

A. Contractor shall provide Project record documents for field engineering and surveying in accordance with Section 01 78 39 – Project Record Documents.

B. Contractor shall provide certified weir elevation survey report in accordance with the requirements specified in this Section.

3.03 PROTECTION

A. Contractor shall preserve and protect bench marks, reference points and stakes. Contractor shall re-establish damaged, destroyed, or lost bench marks, reference points and stakes. Contractor shall remove and re-install equipment and material installed based on Contractor established bench marks, reference points and stakes that have been damaged, destroyed, or lost at no additional cost to Owner.

B. Contractor shall preserve and protect existing and new control points, property markers and monuments during construction of the Work. Contractor shall establish and replace damaged or lost control points, property markers and monuments due to Contractor's construction activities at no cost to the Owner. Contractor shall provide computations and calculations to establish location of replacement Work.

END OF SECTION

SECTION 01 71 33

PROTECTION OF WORK AND PROPERTY

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Protection of existing utilities and structures.

2. Protection of installed equipment and materials.

3. Protection during inclement weather.

4. Reporting of accidents.

5. Barricades and warning signals.

B. Contractor shall be responsible for taking all precautions, providing all programs, and taking all actions necessary to protect the Work and all public and private property and facilities from damage, as specified in the General Contract Conditions, Special Contract Conditions, and this Section.

C. To prevent damage, injury, or loss, Contractor's actions shall include the following:

1. Storing apparatus, materials, supplies, and equipment in an orderly, safe manner that does not unduly interfere with progress of the Work or work of other contractors or utility companies.

2. Providing suitable storage facilities for equipment and materials subject to damage or degradation by exposure to weather, theft, breakage, or other cause.

3. Placing upon the Work or any part thereof only loads consistent with the safety and integrity of that portion of the Work and existing construction.

4. Frequently removing and disposing of refuse, rubbish, scrap materials, and debris caused by Contractor's operations so that, at all times, the Site is safe, orderly, and workmanlike in appearance.

D. Contractor has full responsibility for preserving public and private property and facilities on and adjacent to the Site. Direct or indirect damage done by, or on account of, any act, omission, neglect, or misconduct by Contractor in executing the Work, shall be restored by Contractor, at his expense to condition equal to that existing before damage was done.

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E. Contractor shall comply with safety regulations required by Owner or authorities having jurisdiction. Contractor shall comply with and correct unsafe conditions created or caused by Contractor's personnel. In the event Contractor fails to comply, Owner

receives the right to take necessary measures to correct conditions or practices for reimbursement by Contractor.

F. Related Sections:

1. Section 01 26 00 – Contract Modification Procedures

1.02 REFERENCES

A. Definitions:

1. "Existing utilities" shall refer to both publicly-owned and privately-owned utilities such as, but are not limited to, electric power and lighting, telephone, water, gas, storm drains, process lines, sanitary sewers and all appurtenant structures.

2. "Surface structures" are existing buildings, structures, and other facilities at or above ground surface, including their foundations or any extension below ground surface. Surface structures include, but are not limited to, buildings, tanks, walls, channels, open drainage, exposed piping and utilities, poles, exposed wires, posts, signs, markers, curbs, walks, fencing, and other facilities visible at or above ground surface.

1.03 SITE CONDITIONS

A. Location of Existing Utilities and Structures:

1. Contractor shall confirm and verify location of existing utilities and structures at the Site prior to commencing the Work.

2. Contractor shall notify and obtain approval from authority having jurisdiction prior to performing the Work in the vicinity of the existing utilities and structures.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 PROTECTION OF EXISTING UTILITIES AND STRUCTURES

A. General:

1. Contractor shall satisfy Engineer that methods and procedures for protection have been approved by authorities having jurisdiction prior to proceeding with the Work.

2. Contractor shall provide temporary support and protection, as required, to existing utilities and structures during the Work, including excavation.

a. Temporary support and protection of existing utilities shall be provided in accordance with requirements of the authority having jurisdiction.

b. Temporary support and protection of existing structures shall be provided as directed by the Engineer.

3. Contractor shall be responsible for costs incurred for temporary support or protection provided by a third-party or authority having jurisdiction to ensure safety of the existing utility, Owner, and public and private parties.

B. Existing Buried Utilities:

1. Contractor shall perform field investigate to identify conflicts or interferences between existing utilities and utility Work prior to excavation Work.

a. Investigation of conflicts and interferences shall be performed on Site locations, elevations, slopes, etc. of the existing utilities determined during the field investigations.

b. Contractor shall notify Engineer and Owner in writing of identified conflicts or interferences. Contractor shall not proceed with the Work until written authorization is provided by the Engineer.

c. Identified conflicts and interferences shall be handled in accordance with the Contract Documents. If required, potential modification to the Contract Documents shall be performed in accordance with Section 01 26 00 – Contract Modification Procedures.

2. Contractor shall perform the Work to prevent disruption of existing service and damage to existing utilities.

a. Temporary connections shall be provided, as required, to provide un-interrupted service of existing utilities.

b. Contractor shall repair damage to existing utilities as directed by the Engineer or the authority having jurisdiction at Contractor’s own expense.

c. Contractor shall be responsible for damages and repair costs to the authority having jurisdiction if third-party or authority having jurisdiction personnel repair damaged existing utilities.

C. Protection of Existing Structures:

1. Contractor shall sustain existing surface structures in existing place and protect from direct or indirect injury located within or adjacent to the limits of the Work. Such sustaining and supporting shall be done carefully and as required by the party owning or controlling such structure or facility.

2. Contractor shall bear all risks attending the presence or proximity of all surface structures within or adjacent to limits of the Work, in accordance with the Contract Documents.

3. Contractor shall be responsible for damage and expense for direct or indirect injury caused by his Work to structures and facilities.

4. Contractor shall repair immediately damage caused by his Work, to the satisfaction of owner of damaged structure or facility at no cost to the Owner.

5. Contractor shall provide temporary weather protection for existing structures and buildings where exterior walls or roofs are modified or disturbed in the Work. Contractor shall be responsible for damages due to inadequate protection of existing structures and building.

D. Relocation of Surface Structures: Existing surface facilities, including but not limited to guard rails, posts, guard cables, signs, poles, markers, curbs, and fencing, that are temporarily removed to facilitate the Work shall be replaced and restored to their original condition at Contractor's expense.

3.02 PROTECTION OF INSTALLED EQUIPMENT AND MATERIALS

A. Contractor shall protect installed equipment and materials equipment to prevent damage, injury or loss from subsequent operations. Remove protection facilities when no longer needed prior to completion of the Work.

B. Control traffic to prevent damage to equipment, materials, and surfaces.

C. Coverings: Provide coverings to protect materials and equipment from damage.

3.03 PROTECTION DURING INCLEMENT WEATHER

A. Contractor shall not perform Work during inclement or unsuitable weather that will affect the quality of the completed Work.

B. Contractor shall take necessary precautions in the event of impending inclement weather to protect equipment, materials and Work from damage or deterioration due to floods, driving rain, wind, or snow storms.

1. Owner reserves the right to require additional protection measures beyond Contractor's proposed protection measures to protect the Work.

2. Contractor shall not claim additional compensation for additional protection measures required by Owner nor for damages to equipment, material, or Work due to the inclement weather.

C. When directed by Engineer, Contractor shall stop Work and protect new Work by protective covering during rain storms for, but not limited to, the following:

1. Concrete mixing and placement.

2. Paving placement.

3. Masonry installation.

4. Buried piping, valve and appurtenance installation.

5. Additional inclement weather requirements and limitations are specified in individual Specification Sections.

3.04 REPORTING OF ACCIDENTS

A. Contractor shall immediately report, in writing, to Engineer and Owner accidents out of, or in conjunction with, the performance of Work.

1. Accident reporting includes on Site and adjacent to Site, which cause death, personal injury, or property damage.

2. Written report shall provide full details and witness statements.

3. If claim is made against Contractor, Supplier, or Subcontractor due to accident, Contractor shall promptly report facts, in writing, to Engineer and Owner, with full account of the claim.

B. Contractor shall immediately report death, serious injury, or serious damage caused by telephone or messenger to Engineer and Owner.

3.05 BARRICADES AND WARNING SIGNALS

A. General:

1. Where the Work is performed on or adjacent to roadway, access road, right-of-way, or public place:

a. Provide barricades, fences, lights, warning signs, danger signals, watchmen, and take other precautionary measures for protecting persons, property, and the Work.

b. Paint barricades to be visible at night.

c. From sunset to sunrise, furnish and maintain at least one light at each barricade.

d. Erect sufficient barricades to keep vehicles from being driven on or into Work under construction.

e. Furnish watchmen in sufficient numbers to protect the Work.

B. Provide temporary barricades to protect personnel and property for Work not in or adjacent to vehicular travel areas, including indoor work, in accordance with Laws and Regulations.

C. Contractor's responsibility for maintaining temporary barricades, signs, lights, and for providing watchmen shall continue until the Work is accepted in accordance with the Contract Documents.

END OF SECTION

SECTION 01 73 00

DEMOLITION AND EXECUTION OF WORK

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Contractor shall provide labor, materials, tools, equipment, and incidentals shown, specified, and required for execution of the Work as specified in this Section, including the following:

    a. Construction Electronic Documentation

    b. Demolition

    c. Cutting and Coring

    d. Patching

    e. Installation

2. Requirements for demolition, removal and disposal of existing buildings, structures, pavement, curbs, and sidewalks and electrical, plumbing, heating and ventilation equipment and materials as indicated in the Contract Documents for demolition.

3. General requirements for installation of equipment and material. Additional installation requirements are included in the individual Specification Sections.

4. General requirements for connections to existing facilities. Requirements for tie-ins and shutdowns necessary to complete the Work are included in Section 01 14 00 – Coordination with Owner's Operations.

    a. To extent possible, materials, equipment, systems, piping, and appurtenances that will be placed into service upon completion of connection to existing facilities shall be checked, successfully tested, and in condition for operation prior to making connections to existing facilities, if valves, gates, or similar watertight and gastight isolation devices are not provided at the connection point.

5. Requirements for cutting and coring, and rough and finish patching of holes and openings in existing construction. Provide cutting, coring, fitting, and patching, including attendant excavation and fill, required to complete the Work, and to:

    a. Remove and replace defective Work.

    b. Remove samples of installed Work as specified or required for testing.

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c. Remove construction required to perform required alterations or additions to existing work.

d. Connect to completed Work not performed in proper sequence.

e. Remove or relocate existing utilities and pipes that obstruct the Work in locations where connections must be made.

f. Make connections or alterations to existing or new facilities.

B. Related Sections:

1. Section 01 14 00 – Coordination with Owner's Operations

2. Section 01 51 00 – Temporary Utilities

3. Section 01 57 00 – Temporary Controls

4. Section 01 61 00 – Product Requirements and Options

5. Section 01 66 00 – Product Storage and Protection Requirements

6. Section 01 74 00 – Cleaning and Waste Management

7. Section 01 79 00 – Instruction of Owner's Personnel

8. Section 02 41 00 – Site Demolition

1.02 REFERENCES

A. Definitions:

1. "Manufacturer's installation instructions" includes manufacturer's written instructions; drawings; illustrative, wiring, and schematic diagrams; diagrams identifying external connections; and other such information pertaining to installation of equipment and materials. Installation instructions are printed instructions, including those attached to the equipment and materials, all inclusive.

2. "Salvage" items are equipment and materials shown on the Contract Documents for selective removal by the Contractor to furnish to the Owner. Contractor shall be responsible for removal, handling, and depositing of equipment and material to location designated by Owner.

B. Reference Standards:

1. 29 CFR 1910, OSHA.

2. ANSI A10.2, Safety Code for Building Construction

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Review installation procedures under other Sections and coordinate Work that must be performed with or before the Work specified in this Section.

2. Notify other contractors in advance of Work for connections to existing facilities to prevent delay of the Work.

3. Remove and dispose of equipment and materials indicated for demolition on the Contract Documents, unless indicated as salvage items for the Owner. Contractor shall obtain ownership of removed equipment and materials following Engineer and Owner approval. Disposal of equipment and materials shall be in accordance with the Contract Documents

B. Sequencing:

1. Contractor shall remove and demolish equipment and materials in sequence specified in Section 01 14 00 – Coordination with Owner's Operation and following approval by Engineer and Owner.

2. Contractor shall replace equipment and materials removed without proper authorization from Engineer, which are necessary for the operation of the existing facilities. Re-installation of equipment and materials shall be to the satisfaction of the Engineer at no cost to the Owner

C. Title to Equipment and Materials:

1. Equipment and materials indicated for demolition and removal in the Contract Documents, and not designated as Owner's salvaged items, shall become the Contractor's property following removal from the Site. Contractor shall be responsible for legally disposing of the equipment and material.

2. Contractor shall have no right or title to any of the equipment, materials, or other items to be removed until the elements have been removed from the Site.

3. Contractor shall not sell or assign or attempt to sell or assign any interest in the equipment, materials, or other items until removal from Site.

4. Contractor shall have no claim against the Owner because of the absence of equipment, fixtures, and materials.

D. Salvage Equipment and Materials:

1. Contract Documents indicate equipment and materials that shall be retained by Owner. Owner has the right to request any demolished equipment and materials be retained at their discretion.

2. Contractor shall move salvaged equipment and materials to storage areas located at the Site as instructed by Owner.

3. Architectural equipment and materials may be salvaged for incorporation into the Work when approved by Engineer.

E. Use of Explosives: Contractor shall not use explosives or blasting equipment and material in the Work in accordance with the Contract Documents.

1.04 SUBMITTALS

A. Action/Informational Submittals:

1. Construction electronic documentation as specified in this Section.

2. Demolition Plan: Submit detailed description of methods, equipment, and sequence for demolition Work, including means of ensuring stability of structures during demolition activities.

3. Cutting and Patching Request:

a. Submit written request to Engineer, well in advance of executing cutting or alteration that affects one or more of the following:

1) Design function or intent of Project.

2) Work of Owner or other contractors.

3) Structural value or integrity of an element of the Project.

4) Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.

5) Efficiency, operational life, maintenance, or safety of operational elements.

6) Visual qualities of sight-exposed elements.

b. Request shall include:

1) Identification of Project and contract name and number.

2) Description of affected Work of Contractor and work of others (if any).

3) Necessity for cutting.

4) Effect on work of Owner, other contractors (if any), and on structural or weatherproof integrity of Project.

5) Description of proposed Work, including scope of cutting and patching; trades who will be executing the Work; products proposed to be used; extent of refinishing; schedule of operations; alternatives to cutting and patching, if any.

6) Designation of entity responsible for cost of cutting and patching, when applicable.

7) Written permission of other contractors (if any) whose work will be impacted.

4. Recommendation Regarding Cutting and Patching:

a. Should conditions of work, or schedule, indicate a change of materials or methods, submit written recommendation to Engineer including:

1) Conditions indicating change.

2) Recommendations for alternative materials or methods.

3) Items required with substitution request, in accordance with the substitution request requirements of the Contract Documents and Section 01 61 00 – Product Requirements and Options.

5. Product Data: Submit manufacturer's product data for the protective compound to be applied to core-drilled surfaces and cut concrete surfaces, as well as means of protecting exposed reinforcement or other metal embedments.

6. Informational Submittal: Submit written indication designating the day and time that the construction associated with cutting and patching will be uncovered, to allow observation. Do not begin cutting or patching operations until submittal is accepted by Engineer.

7. Comply with submittal requirements of individual Specification Sections for patching materials.

1.05 SITE CONDITIONS

A. Owner does not assume responsibility for the actual condition of structures and equipment to be demolished and removed.

B. Existing Site conditions shall be maintained to the greatest extent possible by the Owner to the time of Notice to Proceed.

C. Contractor shall perform investigations, explorations, and probes as necessary at the Site prior to initiating demolition Work to ascertain any required protective measures before proceeding with demolition and removal. Contractor shall give particular attention to shoring and bracing requirements to prevent damage to the Work and existing structures.

D. Contractor shall verify measurements, dimensions and other conditions of each existing structure, system, equipment, and material indicated in the Contract Documents for new Work prior to ordering equipment and materials.

PART 2 – PRODUCTS

2.01 MATERIALS

A. General:

1. Provide materials and products in accordance with the individual Specification Sections and the Contract Documents.

2. Provide materials and products that visually match existing adjacent surfaces to fullest extent possible for exposed surfaces.

3. If not indicated in the Contract Documents, provide materials and products that are identical to existing materials and products affected by the Work.

4. If identical materials and products are unavailable, provide materials and products that shall equal or exceed performance requirements of existing materials and products.

B. Protective Coating Applied to Core-Drilled Surfaces and Cut Concrete Surfaces:

1. All concrete surfaces exposed due to cutting or core drilling shall be coated with an epoxy resin coating such as Sikagard 62 by Sika Corporation, Durakote 240 by Tamms Industries or approved equal.

2. Reinforcement or other metal embedment exposed by concrete cutting or core drilling shall be burned back a minimum of ½ inch below surface and resulting void shall be filled with an epoxy resin binder.

PART 3 – EXECUTION

3.01 CONSTRUCTION ELECTRONIC DOCUMENTATION

A. Pre-Construction Documentation

1. Contractor shall take photographic and video documentation of the Site where Work is being performed. Engineer and Owner reserve the right to be present during documentation.

2. Contractor shall provide both photographic and video documentation at grade-level and aerial of the Site prior to commence Work.

3. Contractor shall submit pre-construction documentation to Engineer and Owner for review. Contractor, Engineer, and Owner shall visit Site to field verify electronic documentation prior to commencing the Work. Site visit verification shall establish existing conditions prior to commencing Work.

B. Construction Progress Documentation

1. Contractor shall document Work progress at locations and construction as directed by Engineer, at a minimum.

2. Contractor shall provide electronic documentation prior to and following any shutdown, switchover, demolition, de-commissioning, cutting, patching, repair, etc. Engineer and Owner reserve the right to be present during documentation.

3. Contractor shall document following exposure of buried utilities, piping, valve, appurtenances, and other underground elements.

4. Engineer reserves the right to provide construction progress documentation to confirm Contractor electronic documentation.

C. Post-Construction Documentation

1. Contractor shall take photographic and video documentation of the Site where Work has been completed and prior to Substantial Completion or partial utilization by Owner. Engineer and Owner reserve the right to be present during documentation.

2. Contractor shall provide both photographic and video documentation at grade-level and aerial of the Site following completion of the Work.

D. Submittal Requirements:

1. Documentation shall be time stamped for verification, including date and time.

2. Documentation shall be organized in a logical manner, such as by structure, building, physical site location, etc. for easy of comparison.

3. Photographic documentation shall be high resolution electronic versions.

4. Documentation shall be submitted to Engineer for review and approval prior to commence Work and at completion of the Work.

3.02 DEMOLITION

A. General:

1. Demolition Work shall comply with the applicable provisions and recommendation of ANSI A10.2, Safety Code for Building Construction, all governing codes, and as specified in this Section.

2. Contractor shall furnish competent and experienced personnel for the various type of demolition and removal Work. Demolition and removal Work shall be performed with regard to the safety of Owner employees, individuals at the Site, and the public.

3. Contractor shall confirm absence of embedded utilities prior to cutting, coring, or demolishing existing concrete and facilities. Verification shall be performed by portable x-ray, ground penetrating radar, or other non-invasive methods.

   a. Contractor shall notify Engineer and Owner if embedded utilities are located during the investigation. Contractor shall clearly mark and document location of embedded utilities prior to performing the Work.

   b. Contractor shall be responsible for repair and damages caused by exploration, investigation, and performance of the Work at no additional cost to Owner.

4. Contractor shall remove temporary work, such as enclosures, signs, guards, etc. when such temporary Work is no longer required or when directed at the completion of the Work.

5. Contractor shall perform patching, restoration and Work in accordance with individual Specification Sections and details shown on Contract drawings.

6. Contractor shall be responsible for damage caused by demolition Work to existing structures, equipment and materials indicated for reuse or to remain at no additional cost to Owner.

7. Contractor shall maintain a clean working environment during the demolition Work in accordance with Section 01 74 00 – Cleaning and Waste Management.

8. Contractor shall proceed with the demolition work in a sequence designed to maintain the plant in operation in accordance with Section 01 14 00 – Coordination with Owner's Operations.

9. Excavation caused by demolition shall be backfilled with fill free from rubbish and debris. Select fill or structural fill shall be used where specifically required on Contract Drawings.

10. All debris resulting from the demolition and removal work shall be disposed of by the Contractor at a properly permitted facility as part of the work of this Contract. All regulations covering material handling and disposal shall be followed. Material designated by the Engineer to be salvaged shall be stored on the construction site as directed. All other material shall be disposed of off-site by the Contractor at his expense. Burning of any debris resulting from the demolition will not be permitted at the site.

B. Protection during Demolition:

1. Contractor shall provide, erect, and maintain catch platforms, lights, barriers, weather protection, warning signs and other items as required for proper protection of the public, occupants of the building, personnel engaged in demolition Work, and adjacent construction.

2. Contractor shall provide and maintain weather protection at exterior openings to fully protect the interior premises against damage from the elements until such openings are closed by the Work.

3. Contractor shall provide and maintain temporary protection of the existing structure designated to remain where demolition, removal and Work is being done, connections made, materials handled, or equipment moved. Temporary protection shall be provided in accordance with Section 01 71 33 – Protection of Work and Property.

4. Contractor shall take necessary precautions to prevent dust from rising by wetting demolished masonry, concrete, plaster, and similar debris. Unaltered portions of the existing buildings affected by the operations in the Contract Documents shall be protected by dust proof partitions and other adequate means. Dust control shall be provided in accordance with Section 01 57 00 – Temporary Controls.

5. Contractor shall provide adequate fire protection in accordance with Section 01 51 00 – Temporary Utilities and authorities having jurisdiction.

6. Contractor shall perform the demolition Work with minimum traffic interference. Contractor shall not close or obstruct walkways, passageways, or stairways. Contractor shall not store or place materials in passageways, stairs, or other means of egress.

7. Contractor shall minimize disturbances to exterior walls and roofs to small sections that are readily repaired and patched to maintain watertight conditions in existing structures and buildings.

C. Performance of Demolition:

1. Equipment, piping, valves, and appurtenances:

a. Contractor shall drain equipment, piping, valves, and appurtenances prior to demolition Work. Contractor shall be responsible for collection, transport, and disposal of drained contents at no additional cost to the Owner.

b. Contractor shall provide line stops, plugs, blind flanges, etc. for equipment, piping, valves, and appurtenance required to remain in service during the Project. Contractor shall provide temporary or permanent supports in accordance with the Contract Documents.

c. Supports, pedestals and anchors shall be removed with the equipment and piping unless otherwise noted in the Contract Documents.

d. Concrete bases, anchor bolts and other supports shall be removed to approximately 1 inch below the surrounding finished area and the recesses shall be filled with epoxy resin binder.

e. Wall and roof openings shall be closed, and damaged surfaces shall be patched to match the adjacent areas, in accordance with the Contract Documents and as directed by the Engineer.

f. Wall sleeves, wall pipes, and wall castings shall be plugged or blanked off in accordance with the Contract Documents and as directed by the Engineer.

g. Openings in concrete shall be closed in accordance with the Contract Documents and as directed by the Engineer.

2. Electrical components and equipment:

a. Contractor shall de-energize panelboards, lighting fixtures, switches, circuit breakers, electrical conduits, motors, limit switches, pressure switches, instrumentation such as flow, level and/or other meters, wiring, and similar electrical equipment prior to removal.

b. Contractor shall relocate or isolate electrical equipment and materials that serve equipment, piping, valves, and appurtenance that are to remain in service during the Project. Relocation or isolation Work shall be sequenced and scheduled in accordance with Section 01 14 00 – Coordination with Owner’s Operations.

3. Reused and relocated equipment:

    a. Contractor shall receive approval from Engineer prior to removal and relocation of equipment and material. Equipment and materials removed by Contractor prior to Engineer's approval that is required for Owner's operation of the facility shall be reinstalled at no cost to the Owner.

    b. Prior to removal and relocation Work, equipment and materials indicated for reuse and relocation shall be operated by Owner with Contractor and Engineer present to witness existing functionality and operation.

    c. Contractor shall provide personnel responsible for reinstallation of equipment and material for the removal Work.

    d. Contractor shall be responsible and provide storage and protection of equipment and materials in accordance with Section 01 66 00 – Product Storage and Protection Requirements until relocation and reinstallation Work is performed.

    e. Contractor shall provide replacement equipment and material that is damaged during the removal Work at new cost to the Owner. Contractor shall be responsible to provide same type, model, electrical components, etc. equipment and material as approved by Engineer and Owner.

4. Structural removal:

    a. Contractor shall provide and install temporary shoring, struts, and bracing required for the demolition Work to ensure stability during entire demolition process.

    b. Contractor shall cut and remove structural material at the interface of demolition Work and the existing structural element. Cutting and removal shall occur in small sections, including masonry units, to prevent instability of structural elements.

    c. Contractor shall patch, repair, and refinish adjacent surfaces that remain following demolition Work.

        1) Adjacent surfaces shall be repaired and refinished to the condition prior to the demolition Work and in accordance with the Contract Documents.

        2) Adjacent surfaces shall be cleaned of dirt, grease, loose paint, etc., prior to refinishing.

    d. Contractor shall limit cutting of existing roof areas designated to remain to the limits required for the proper installation of the Work.

1) Cut and remove insulation, joists, flashing, membranes, shingles, and metals, etc. in accordance with the Contract Documents and as directed by the Engineer for installation of the Work.

2) Provide temporary weather tight protection as required until new roofing and flashings are installed.

5. Architectural repairs and removal Work, not specifically shown on the Drawings, may include, but not limited to, the following:

a. Brickwork: Re-pointing; removing and replacing broken, cracked, disintegrating and missing materials.

b. Windows: Removing cracked or disintegrating sealant material; replacing missing or broken glass; re-caulking and sealing frames; glazing sealants.

c. Re-finishing: Removing rust, sealing, or peeling paint from surfaces by scraping, sanding or wire brushing; priming and repainting surfaces.

d. Roofing: Patching and repairing membrane or built-up roofing; metal flashing repair; correcting roof pitch to eliminate ponding; cleaning and/or replacing roof drains.

e. Masonry: Cutting and installing new expansion and control joints.

f. Parapets: Removing and construction of new walls and copings; clean and patching of copings; replacing copings where broken.

g. Concrete surfaces: Patching, cleaning, sealing and resurfacing floors, walls, lintels, sills, and trim. Replace lintels where broken. Patching or replacing broken, spalled, cracked and disintegrating concrete encased steel columns and piers.

h. Openings: Cutting and modifying as required for new Work. Provide new lintels, doors, and frames.

i. Doors: Patching and refinishing doors and frames.

j. Ceilings: Patching, refinishing, and replacing.

k. Guards, handrails, and appurtenances: Cleaning and repainting steel materials. Replacing steel material with new aluminum material.

l. Demolished Exterior Openings: Remove window sash, frame, sill, stool and trim at exterior doors indicated for enclosure and sealing. Provide brick and/or masonry block for closure and sealing.

D. Maintenance during Demolition:

1. Contractor shall maintain the buildings, structures, and public properties free from accumulations of waste, debris and rubbish, generated by the demolition Work.

2. Contractor shall provide cleaning and waste management of demolition equipment and materials in accordance with Section 01 74 00 – Cleaning and Waste Management.

3.03 CUTTING AND CORING

A. General:

1. Contractor shall notify Engineer in writing and receiving Engineer's approval prior to cutting load bearing walls (concrete or masonry) and structural concrete floors.

2. Perform cutting and coring to limit extent of patching required.

3. Structural Elements: Do not cut or core structural elements in manner that would change structural element's load-carrying capacity or load deflection ratio.

4. Operating Elements: Do not cut or core operating elements in manner that would reduce capacity to perform as intended. Do not cut or core operating elements or related components in manner that would increase maintenance requirements or decrease operational life or safety.

5. Replace, patch, and repair materials and surfaces cut or damaged during cutting and coring Work. Contractor shall use methods that do not void required or existing warranties.

6. Provide temporary or permanent bypass provisions prior to cutting existing pipe, conduit, ductwork, or other utilities serving facilities scheduled to be removed or relocated in accordance with the Contract Documents.

7. Inspection: Examine and prepare surfaces prior to commencing Work. Contractor shall report unsatisfactory or questionable conditions to Engineer in writing. Contractor shall not proceed with the Work until unsatisfactory conditions are corrected.

8. Preparation:

a. Provide temporary support required to maintain structural integrity, to protect adjacent Work from damage, and to support the element(s) to be cut or cored.

b. Protection of Existing Construction During Cutting and Coring:

1) Protect existing structures, equipment, and materials during cutting and coring to prevent damage.

2) Provide protection from adverse weather conditions that will be exposed during cutting and coring Work.

3) Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

9. Restoration:

a. Clean equipment, materials, piping systems, valves, conduit and appurtenances that were damaged due to the Work prior to applying paint or other finishing materials.

b. Restore damaged pipe coverings, including insulation, to original condition.

B. Cutting:

1. General:

a. Cut existing structures and appurtenances that provide surfaces for installation or repair of the Work. Cut existing construction using methods to minimize damage and disturbance to retained and adjoining construction elements.

b. Cutting equipment used shall be hand or small power tools suitable for sawing or grinding. Avoid using hammering or chopping equipment for cutting Work.

c. Cut holes and slots as small as possible and to size required for incorporation of the Work and in accordance with the Contract Documents.

d. Cut or drill from exposed or finished side to concealed side to avoid marring finished surfaces.

e. Provide adequate bracing of area to be cut prior to cutting.

f. Provide equipment and material to remove cut spoils.

g. Provide temporary protection for cut openings where and when Work is not being performed.

2. Concrete and Masonry:

a. Cut through concrete and masonry using concrete wall saw with diamond saw blades.

b. Provide control for slurry generated during sawing on both sides of element being cut.

c. After cutting concrete and before installing new Work on or through the opening, coat exposed concrete and steel with protective coating material specified in this Section. Apply protective coating in accordance with manufacturer's instructions.

C. Coring:

1. Core-drill holes through concrete and masonry walls, slabs, or arches, in accordance with the Contract Documents, unless written authorization is furnished by Engineer.

2. Protection: Protect existing structures, equipment, materials, utilities, and adjacent areas from water and other damage by core-drilling Work.

3. Coring:

a. Perform coring with non-impact rotary tool using diamond core-drills.

b. Size holes for pipe, conduit, sleeves, equipment, or mechanical seals, as required, to be installed through the penetration and in accordance with the Contract Documents.

c. After core-drilling and before installing equipment and material through the penetration, coat exposed concrete and steel with protective coating material specified in this Section. Apply protective coating in accordance with manufacturer's instructions.

4. Cleaning: Vacuum or otherwise remove slurry and tailings from the work area following core-drilling.

3.04 PATCHING

A. General:

1. Construction shall be patched by filling, repairing, refinishing, closing-up, and similar methods at completion of the Work.

2. Provide equipment and materials in accordance with the Contract Documents for patching Work. Comply with manufacturer's installation instructions.

3. Provide airtight connections to pipes, sleeves, ducts, conduit, and other penetrations through surfaces when patching the Work. Provide durable patching seams that minimize visual appearance.

4. Patched areas shall be tested to demonstrate integrity of installation as directed by the Engineer. Contractor shall provide testing equipment, material, and services for patch testing.

B. Restoration:

1. Restore exposed finishes of patched areas to minimize evidence of patching and refinishing.

2. Contractor shall extend refinishing and restoration into adjoining areas to blend patched areas with existing adjacent areas.

a. Refinish to nearest intersection for continuous surfaces.

b. Refinish the entire assembly and system for equipment and materials.

c. Repair and rehang existing ceilings to provide an even-plane surface of uniform appearance.

d. Apply plaster and finishes to match adjacent interior walls and partition areas for openings sealed with brick and/or masonry block.

3.05 INSTALLATION

A. Install equipment and materials in accordance with the Contract Documents, approved Shop Drawings, and manufacturer's installation instructions. When manufacturer's installation instructions conflict with the Contract Documents, obtain interpretation or clarification from Engineer before proceeding.

B. Preparation of surfaces shall be performed prior to installation of equipment and material.

1. New floor finishes: Repair and patch with concrete, asphalt latex type emulsion and underlayment as required for existing surfaces or new flooring surfaces.

2. Ceramic tile flooring or bases installed over concrete floors: Grind away cove, if present, for installation of new Work.

C. Concrete surfaces shall achieve compression strength in accordance with the Contract Documents prior to installation of equipment and materials.

1. Anchor bolts and templates shall be provided by Contractor and as specified in the individual Specification Sections.

2. Concrete foundations shall be treated with sealer to prevent oil from seeping into concrete as specified in the individual Specification Sections.

D. Maintain the work area in a broom-clean condition while installing materials and equipment.

E. Contractor shall be responsible for equipment for hoisting, lifting, moving, rigging, etc. for installation of equipment and materials.

1. Contractor shall be responsible for design of temporary installation system used for the installation Work, unless otherwise indicated in the Contract Documents.

2. Contractor shall be responsible for damage to existing structure, equipment, and material caused prior, during, and following installation of the Work with the Contractor furnished temporary installation system at no cost to Owner. Repairs shall be in accordance with the Contract Documents, shall return to condition prior to installation Work, and as directed by the Engineer.

3. Owner's hoists, monorails, bridge cranes, rigging, etc. shall not be used by the Contractor unless written authorization is provided by Owner.

F. Alteration or repair of new equipment and materials shall not be permitted without written authorization from Engineer.

G. Field welding or burning of new equipment and materials shall not be permitted unless indicated in the Contract Documents or without written authorization from Engineer.

H. Contractors shall install temporary shoring and bracing where necessary during installation of the Work where required:

1. System shall be provided in accordance with the Contract Documents and code requirements.

2. Temporary system shall consist of adjustable sound timbers or rolled shapes easily removable following installation of the Work.

3. Contractor shall be responsible for damage to existing structures and new Work during installation, utilization, and removal of the temporary system at new additional cost to the Owner.

I. Manufacturer's Installation Services: Provide competent, qualified manufacturer's representatives of equipment and material for services specified in the individual Specification Sections, including, but not limited to:

1. Supervising installation

2. Checking the completed installation

3. Adjusting and testing of equipment and materials

4. Instructing Owner's operations and maintenance in accordance with Section 01 79 00 – Instruction of Owner's Personnel.

END OF SECTION

SECTION 01 73 23

ANCHORAGE AND BRACING OF NONSTRUCTURAL COMPONENTS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Furnish all equipment, labor, materials, and services required to design and provide anchorage and bracing for all nonstructural components in accordance with the Contract Documents and Building Code requirements, including the seismic design requirements of Chapter 13 in ASCE 7.

B. This Section covers requirements for only the anchorage and bracing of nonstructural components. Design requirements for nonstructural components (other than their anchorage and bracing) are covered in the Section for that component.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 45 33 – Special Inspections

B. Section 05 05 23 – Metal Fastening

C. Section 05 10 00 – Metal Materials

D. Further requirements for anchorage and bracing are included in other Sections of the Specifications. See Section for the specific nonstructural component in question.

1.03 DEFINITIONS

A. Nonstructural components: All architectural, mechanical, electrical, or plumbing elements or systems and their supports or attachments provided under this contract which are permanently attached to new or existing structures.

1. Architectural nonstructural components include, but are not limited to, interior nonstructural walls and partitions, exterior wall panels and glazing elements, glass curtain walls, skylights, cabinets, suspended ceilings, fascia, and cladding.

2. Mechanical nonstructural components include, but are not limited to, HVAC units, fans, water and wastewater treatment process equipment, instrumentation cabinets, piping and ductwork.

3. Electrical nonstructural components include, but are not limited to, conduit systems, cable tray systems, boxes, transformers, panelboards, switchboards, switchgear, busway, individual motor controllers, motor control centers, variable frequency drives, automatic transfer switches, and lighting systems.

4. Plumbing nonstructural components include, but are not limited to, sprinkler systems and associated piping, and sump pumps.

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B. Attachment: Elements including anchor bolts, welded connections, and mechanical fasteners which secure nonstructural components or supports to the structure.

C. Essential Components: Nonstructural components considered necessary to public safety for which the component importance factor I_p is required by chapter 13 in ASCE 7 to be taken as 1.5, including:

1. Life safety systems which must function following an earthquake, including but not limited to, sprinklers for fire protection, emergency lighting, egress corridors and stairways, and smoke purge systems.

2. Components which contain, convey or support toxic, highly toxic, or explosive substances where the quantity of the material exceeds a threshold quantity established by the Building Code.

3. Components which are within or attached to an Occupancy or Risk Category IV structure as defined in ASCE 7 Chapter 1 and are needed for continued operation of the facility or failure could impair the continued operation of the facility.

4. Components which contain, convey, or support hazardous substances and are attached to a structure or portion thereof classified by the Building Code as a hazardous occupancy.

D. Nonbuilding Structures: All self-supporting structures which are supported by an independent foundation or by other structures which include, but are not limited to, storage tanks, silos, exhaust stacks, storage racks, and towers.

E. Delegated Design: Design of a structure or structural element(s) which has been deferred by the contract documents to be performed during the project construction stage, by a registered design professional retained by the Contractor and with the design submitted as a shop drawing to the Engineer.

1.04 REQUIREMENTS

A. Anchorage and bracing of nonstructural components shall be designed and installed to resist the controlling load combination of gravity loads, operational forces (including static and dynamic), wind forces, seismic forces and any other applicable forces required in accordance with the governing Building Code.

B. Anchorage and bracing of nonstructural components shall comply with seismic design requirements of ASCE 7 Chapter 13 unless the nonstructural component meets the criteria to be exempt. The following nonstructural components are exempt from requirements specific to seismic anchorage and bracing: (See paragraph 1.07.F.3 herein for Seismic Design Category)

1. Storage cabinets no more than 6 feet tall, furniture, and movable equipment, regardless of Seismic Design Category.

2. All architectural, mechanical, electrical, and plumbing nonstructural components in Seismic Design Category A.

3. All mechanical, electrical, and plumbing nonstructural components in Seismic Design Category B.

4. Architectural nonstructural components in Seismic Design Category B, other than parapets, provided that $I_p = 1.0$.

5. Mechanical, electrical, and plumbing nonstructural components in Seismic Design Category C provided that either:

   a. $I_p = 1.0$, and the component is positively attached to the structure, or

   b. Component weighs 20 lbs. or less, or 5 lb/ft or less for distribution systems.

6. Mechanical, electrical, and plumbing nonstructural components in Seismic Design Category D, E or F that are positively attached to the structure, provided that either:

   a. $I_p = 1.0$, component weighs 400 lbs or less and its center of mass is 4 ft or less above a floor level, and flexible connections are provided between the components and associated ductwork, piping and conduit: or

   b. Component weighs 20 lbs. or less, or 5 lb/ft or less for distribution systems.

7. Other exemptions as allowed by the Specifications, Codes and Standards referenced herein.

1.05 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the Specifications, all work herein shall conform to or exceed the applicable requirements of the following documents. The Building Code shall be the version in effect at the time of Bid within the jurisdiction where the Work is located. All other referenced specifications, codes, and standards refer to the version as referenced by the Building Code. If no version is referenced by the Building Code, then the most current issue available at the time of Bid shall be used.

1. New York State Building Code

2. ASCE/SEI 7 Minimum Design Loads for Buildings and Other Structures

3. NFPA 13 Standard for Installation of Sprinkler Systems

4. FEMA 412 Installing Seismic Restraints for Mechanical Equipment

5. FEMA 413 Installing Seismic Restraints for Electrical Equipment

6. FEMA 414 Installing Seismic Restraints for Duct and Pipe

7. SMACNA Sheet Metal and Air Conditioning Contractors' National Association, Seismic Restraint Manual: Guidelines for Mechanical Systems

8. ACI 318 Building Code Requirements for Structural Concrete and Commentary

9. ACI 355.2 Qualifications of Post-Installed Mechanical Anchors in Concrete

10. ACI 355.4 Qualifications of Post-Installed Adhesive Anchors in Concrete

1.06 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures.

1. Anchorage and bracing submittals for all architectural, mechanical, electrical, and plumbing nonstructural components, elements and systems that do not have a design for anchorage and bracing provided within the Contract Documents. Submittals shall include the following:

a. Component manufacturer's cut sheets and fabrication details for equipment bases and foundations, including dimensions, structural member sizes, support point locations and equipment operational loads. Equipment anchorage details shall clearly indicate anchor size, pattern, embedment, and edge distance requirements to satisfy operational, wind, seismic and other forces required by the governing Building Code. Details shall also indicate grout, bearing pads, isolators, etc. required for complete installation.

b. Design calculations, signed and sealed by a Professional Engineer registered in New York State. Design shall include all loads and load combinations required by the governing Building Code. Separate calculation submittals for vertical and lateral load support systems shall not be allowed.

c. Detailed Shop Drawings, signed and sealed by a Professional Engineer registered in New York State, showing specific details of the support design including material, installation, attachments, connection hardware, etc., and the layout and location of all hangers and supports (resisting both gravity and lateral loads), including bracing orientation and direction of force(s) to be resisted.

d. Seismic loads and requirements are not required to be included in design for anchorage and bracing of components which are exempt in accordance with Section 1.04B.

e. For components required to be certified as seismically qualified in accordance with paragraph 1.06.A.1.f below, submit installation guidelines

provided by the equipment manufacturer for proper seismic mounting of the equipment.

f. Seismic qualification testing shall be based on ASCE 7 and on a nationally recognized testing standard procedure such as ICC-ES AC 156.

1.07 DESIGN REQUIREMENTS

A. Mechanical fasteners used to secure nonstructural components shall meet the requirements of Section 05 05 23 – Metal Fastening. Post-installed concrete anchors shall be prequalified for use in seismic applications.

B. No reaction loads (either vertical or lateral) from nonstructural component anchorage and bracing shall be allowed on any element where design has been delegated unless the additional loads on the element have been coordinated with the delegated designer and the submittal is accompanied by a sealed letter from the delegated designer indicating the element has been designed to support the reaction loads.

C. Reaction loads from nonstructural component anchorage and bracing shall be transferred directly to the primary structural members (girders, beams, etc.), with no components supported from secondary members (purlins, bracing, etc.) unless otherwise approved.

D. No holes shall be drilled into any structural steel for attachment of component supports without prior approval of the Engineer.

E. Attachments of nonstructural component anchorage and bracing that cause overstressing of any structural element shall not be permitted.

F. Seismic Requirements

1. Seismic anchorage and bracing for nonstructural components shall be subject to the current local Building Code in conjunction with the seismic provisions of the International Building Code (IBC) Section 1613 and referenced ASCE 7 Chapter 13.

2. Where the weight of a nonstructural component is greater than or equal to 25 percent of the effective seismic weight (as defined by ASCE 7) of the structure it is attached to, the component shall be classified as a nonbuilding structure for purposes of seismic design. Seismic design for nonbuilding structures shall comply with Building Code requirements in conjunction with the provisions of ASCE 7 Chapter 15.

3. Nonstructural components shall be assigned to the same Seismic Design Category as the structure they occupy or to which they are attached. Design of seismic support system and anchorage shall incorporate the site-specific seismic

criteria given on the Contract Drawings. Criteria shall include site-specific spectral response coefficients, Site Class, Seismic Design Category, and Risk Category.

4. Component Importance Factor Ip shall be 1.5 for all essential nonstructural components noted in item 1.03.E above. All other nonstructural components shall utilize I_p = 1.0 unless noted otherwise.

5. Components shall be anchored and braced for earthquake forces both in the vertical and each orthogonal direction. Seismic anchorage and bracing shall limit deflections of components per ASCE 7, and the displacements shall not impede component functionally and containment.

6. Anchorage design shall account for disparate seismic response behavior of supporting structures. Seismic supports or bracing shall not cross structural expansion joints. Nonstructural components shall not be attached to multiple structural elements which may respond differently during a seismic event without provisions to accommodate independent movement. Flexible expansion loops or offsets, flexible joints, bellows type pipe expansion joints, couplings, etc. shall be provided at structure expansion joints to allow for independent structure movement and thermal movement of piping, ductwork, and conduit. Minimum movement capability in the vertical and each orthogonal direction shall equal the width of the joint.

7. Provide flexible connections, piping, conduit, etc. at foundation levels where below grade utilities enter the structure.

8. Design of support system for components with multiple attachments shall consider the stiffness and ductility of the supporting members. Equipment designed as free-standing shall only be attached at its base. Use of non-free-standing equipment requiring both vertical and lateral attachment is contingent upon loads applied to the structure and requires approval by the Engineer.

9. The seismic anchorage and bracing design shall be based on actual equipment data (dimensions, weight, center of gravity, etc.) obtained from the specifications or the approved equipment manufacturer. The equipment manufacturer shall verify the attachment points on the equipment can safely withstand the combination of seismic, self-weight and other loads imposed.

G. Powder actuated fasteners in steel or concrete shall not be used for sustained tension loads in Seismic Design Categories D, E or F unless approved for seismic loading or specifically exempted by ASCE 7. Powder actuated fasteners in masonry shall not be used unless approved for seismic loading regardless of Seismic Design Category.

H. Friction clips shall not be used in Seismic Design Categories D, E or F for supporting sustained tension loads in combination with resisting seismic forces. C-type and large flange clamps may be used for hanger attachments provided restraining straps meeting

NFPA 13 requirements are utilized and loosening of threaded connections is prevented by lock nuts, burred threads, etc.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Anchorage and bracing of nonstructural components shall be constructed of appropriate materials and connecting hardware to provide a continuous load path between the component and supporting structure of sufficient strength and stiffness to resist the calculated design seismic forces and displacements.

B. Component anchorage, bracing and connection materials shall be compatible with and in general match the component and component gravity support materials. Contact between dissimilar metals shall be prevented.

PART 3 – EXECUTION

3.01 INSTALLATION OF ANCHORAGE AND BRACING

A. No anchorage and bracing of nonstructural components shall be installed prior to review and acceptance by the Engineer and permitting agency.

B. Equipment shall be installed per the manufacturer's recommendations. Fasteners shall meet manufacturer's requirements.

C. Following installation, all anchorage and bracing and seismically qualified equipment shall be inspected. See Section 01 45 33 – Special Inspections for requirements.

END OF SECTION

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SECTION 01 74 00
CLEANING AND WASTE MANAGEMENT

PART 1 – GENERAL

1.01 SUMMARY

A. Administrative and procedural requirements for progress and closeout cleaning at the Site.

1. Contractor shall execute cleaning during the Project, at completion of the Work, and as required by the General Contract Conditions and this Section.

2. Maintain in a clean manner the Site, the Work, and areas adjacent to or affected by the Work.

B. Administrative and procedural requirements for disposing of non-hazardous excavation and construction waste.

1. Contractor shall comply with the requirements and procedures for construction waste management and disposal, including developing and implementing a plan for construction waste management and disposal.

2. Extent of required construction waste management and disposal includes within the Project limits, as shown or indicated.

1.02 REFERENCES

A. Definitions:

1. “Waste Management Coordinator” is the person responsible for implementing, monitoring, and reporting the status of the Waste Management Plan. Although available for other assignments, the Waste Management Coordinator shall be present at the Site full time for the duration of the Work.

2. “Construction waste” is building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

3. “Demolition waste” is building and site improvement materials resulting from demolition or selective demolition operations.

4. “Disposal” is removal to an off-Site location of demolition and construction waste and subsequent sale, recycling, reuse, or disposal in a landfill or incinerator conforming to Laws and Regulations and acceptable to authorities having jurisdiction.

B. Reference Standards: NFPA 241, Safeguarding Construction, Alteration, and Demolition Operations

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1.03 ADMINISTRATIVE REQUIREMENTS

A. Waste Management Plan:

1. General: Develop preliminary plan consisting of waste identification. Indicate quantities by weight or volume. Use the same units of measure throughout waste management plan.

2. Waste Identification: Indicate anticipated types and quantities of excavation waste generated by the Work.

3. Landfill Diversion Goals: Describe how landfill diversion goals will be achieved using the Contractor's chosen, eligible haulers and processing facilities for each material stream.

    a. All excavated soils shall be beneficially reused.

    b. Asphalt, concrete, and wood waste streams shall be recycled at local facilities.

    c. Contractor shall make provisions to locally recycle or reuse minor waste streams such as packaging material, office waste, food/beverage packaging and materials without dimensional estimates, to the extent possible.

4. Waste Reduction Work Plan: List each type of waste and whether waste will be recycled or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

    a. Salvaged Materials for Reuse: For materials that will be salvaged and reused in the Work, describe methods for preparing salvaged materials before incorporating them into the Work.

    b. Disposed Materials: Provide information on how and where materials will be disposed. Include name, address, and telephone number of each landfill and incinerator facility that will be used.

    c. Recycled Materials: Provide information on how and where materials will be recycled. Include name, address, and telephone number of each facility that will be used.

    d. Handling and Transportation Procedures: Provide information on the method(s) that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location at the Site where materials separation will be located.

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B. Failure of Contractor to Maintain Clean Site and Waste Management Plan:

1. Owner will provide written notification to Contractor for failure to maintain a clean Site and waste management plan.

2. Written notification shall provide five (5) days for Contractor to remedy Site cleaning and waste management to the Engineer's and Owner's satisfaction.

3. Following the five (5) day remedy period, Owner shall without prejudice to any other rights provide services to clean Site to the satisfaction of Owner and Engineer. Contractor shall be responsible for reimbursement of Owner's costs and expenses for the cleaning work.

1.04 SUBMITTALS

A. Action/Informational Submittals:

1. Preliminary Waste Management Plan: Prepare in accordance with this Section and submit within 14 days of the Notice to Proceed and prior to removing waste from the Site.

2. Final Waste Management Plan: Submit within 14 days of receiving Engineer's comments on the preliminary waste management plan.

B. Closeout Submittals:

1. Landfill and Incinerator Disposal Records: Provide copy of receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Submit manifests, weight tickets, receipts, and invoices.

1.05 DELIVERY, STORAGE AND HANDLING

A. Replace loaded containers with empty containers as demand requires.

B. Deposit recyclable materials in containers free from debris.

C. Transport and deposit waste in containers to minimize dust. Close container covers immediately after materials are deposited.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 PROGRESS CLEANING

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A. General: Clean the Site, work areas, and other areas occupied by Contractor at least weekly. Dispose of materials in accordance with the General Contract Conditions and the following:

1. Comply with NFPA 241 for removing combustible waste materials and debris.

2. Do not hold non-combustible materials at the Site more than three days if the temperature is expected to rise above 80 degrees F. When temperature is less than 80 degrees F, dispose of non-combustible materials within seven days of their generation.

3. Provide suitable containers for storage of waste materials and debris.

4. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately.

B. Work Areas:

1. Clean areas where the Work is in progress to level of cleanliness necessary for proper execution of the Work.

2. Remove liquid spills promptly and immediately report spills to Owner, Engineer, and authorities having jurisdiction.

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

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

C. Installed Work: Keep installed Work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of material or equipment installed, using only cleaning agents and methods specifically recommended by material or equipment manufacturer. If manufacturer does not recommend specific cleaning agents or methods, use cleaning agents and methods that are not hazardous to health and property and that will not damage exposed surfaces.

D. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration until Substantial Completion.

E. Cutting and Patching:

1. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

2. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

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F. During handling and installation of materials and equipment, clean and protect construction in progress and adjoining materials and equipment already in place. Apply

protective covering where required for protection from damage or deterioration, until Substantial Completion.

G. Clean completed construction as frequently as necessary throughout the construction period.

3.02 EXCAVATION WORK NEAR PUBLIC OR PRIVATE PROPERTY

A. Contractor shall provide cleaning and either temporary or permanent restoration where Work is located in or near streets, right of ways, easements, or private property.

B. Contractor shall backfill, compact, grade, and restore excavation or disturbed area to functional condition to permit pedestrian or vehicular traffic and original use of the area as the Work progresses.

C. Temporary storage of excavation spoils, including earth, stones, boulders, and debris, shall be removed from the Site or area of disturbance.

3.03 CLOSEOUT CLEANING

A. Complete the following prior to requesting inspection for Substantial Completion:

1. Clean and remove from the Site rubbish, waste material, debris, and other foreign substances.

2. Sweep paved areas broom-clean. Remove petrochemical spills, stains, and other foreign deposits.

3. Hose-clean sidewalks and loading areas.

4. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.

5. Repair pavement, roads, sod, and other areas affected by construction operations and restore to specified condition; if condition is not specified, restore to pre-construction condition.

6. Clean exposed exterior and interior hard-surfaced finishes to dirt-free condition, free of spatter, grease, stains, fingerprints, films, and similar foreign substances.

7. Leave the Site clean, and in neat, orderly condition, satisfactory to Owner and Engineer.

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3.04 WASTE MANAGEMENT IMPLEMENTATION

A. General: Implement the waste management plan approved by Engineer. Provide handling, containers, storage, signage, transportation, and other items required to implement the waste management pan during the Project.

B. Training: Train all installers, Subcontractors, and Suppliers as required on proper waste management procedures required for the Work.

1. Distribute the waste management plan as required within three days of Engineer's approval.

2. Distribute the waste management plan to Contractor's personnel, Subcontractors, and Suppliers prior to these entities starting the Work. Review with installers, Subcontractors, and Suppliers the waste management plan's procedures and locations established for salvage, recycling, and disposal.

C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent facilities. Designate and label specific areas of the Site necessary for separating materials to be disposed.

3.05 WASTE DISPOSAL

A. General: Except for items or materials to be recycled, or otherwise reused, remove waste materials from the Site and properly dispose of waste in facility such as permitted landfill or incinerator or other method acceptable to authorities having jurisdiction.

1. Except as otherwise specified, remove from the Site all waste and debris from the Work as it accumulates. Upon completion of the Work, remove materials, equipment, waste, and debris and leave the Site clean, neat, and orderly. Comply with the Contract Documents regarding cleaning and removal of trash, debris, and waste.

2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

3. Properly dispose of waste materials, surplus materials, debris, and rubbish off the Site.

4. Do not discharge volatile or hazardous substances, such as mineral spirits, oil, or paint thinner, into storm sewers or sanitary sewers.

5. Do not discharge wastes into surface waters or drainage routes.

B. Burying: Do not bury rubbish and waste materials at the Site.

C. Burning: Do not burn waste materials at the Site.

D. Disposal: Transport waste materials to proper location at site other than Owner's property for disposal in accordance with Laws and Regulations. Contractor shall be solely responsible for complying with Laws and Regulations regarding storing, transporting, and disposing of waste.

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END OF SECTION

NO TEXT ON THIS PAGE

SECTION 01 75 00

CHECKOUT AND STARTUP PROCEDURES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Checkout of products and equipment.

2. Startup procedures of products and equipment

B. Contractor shall initially start up and place equipment installed under the Contract into successful operation, in accordance with the equipment manufacturer's written instructions and as instructed by Supplier at the Site.

C. Provide all material, labor, tools, and equipment required to complete equipment checkout and start-up.

D. Provide all fuel, electricity, water, filters, chemicals, and other expendables required for initial start-up of equipment unless otherwise specified..

E. General activities include:

1. Cleaning, as required under other provisions of the Contract Documents.

2. Removing temporary protective coatings.

3. Checking and correcting (if necessary) leveling plates, grout, bearing plates, anchorage devices, fasteners, and alignment of piping, conduits, and ducts that may place stress on the connected equipment.

4. All adjustments required.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate checkout and start-up with other contractors performing Work at the Site.

2. Do not start up system or subsystem for continuous operation until all components of that system or subsystem, including instrumentation and controls, have been tested to the extent practicable and proven to be operable as intended by the Contract Documents.

3. Responsibility for proper operation is by Contractor.

4. Supplier shall be present during checkout, start-up, and initial operation, except as otherwise specified.

5. Do not start up system, unit process, or equipment without submitting acceptable preliminary operations and maintenance manuals by Contractor, in accordance with Section 01 78 23 – Operations and Maintenance Data.

B. Contractor's Requirements Prior to Owner's Responsibility:

1. Owner will assume responsibility for the equipment upon Substantial Completion.

2. Prior to turning over to Owner responsibility for operating and maintaining system or equipment shall be in accordance with this Section and the following requirements:

a. Submit acceptable final operations and maintenance manuals in accordance with Section 01 78 23 – Operations and Maintenance Data.

b. Provide training of operations and maintenance personnel in accordance with Section 01 79 00 – Instruction of Owner's Personnel.

c. Complete system field quality control testing in accordance with the Contract Documents including, but not limited to, the following:

1) Start-up certification shall be performed and completed by the equipment Supplier for the equipment and material prior to be placed into intended use by Owner as specified in the Contract Documents.

2) Equipment and material shall be operated for a minimum 30-day operational period to verify performance. In addition to specific requirements specified in the individual specification sections, process data that is recorded in the PLC shall be submitted to the Engineer in tabular format showing hourly process performance data. A log of all alarms shall also be submitted, along with notes describing corrective measures applied in response to alarm condition.

3) If equipment and material does not perform satisfactorily during the 30-day operational period, then the warranty period start shall be delayed until satisfactorily performance is verified.

a) Contractor shall repair or replace equipment and material that does not perform satisfactorily at no cost to Owner.

b) Contractor shall furnish all equipment and material, labor, and incidentals necessary to provide equipment and material to the performance level required by the Contract Documents.

d. Obtain from Engineer final certificate of Substantial Completion for either entire Work or the portion being turned over to Owner.

1.03 SUBMITTALS

A. Startup Schedule: Detailed summary of schedule, duration, manpower requirement, and Contractor's means and methods for startup.

B. Closeout Submittals: Manufacturer's certification of installation in accordance with this Section.

C. Startup testing and operational demonstration performance data.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 PRELIMINARY REQUIREMENTS

A. Prior to the start-up of the facilities, Contractor shall have prepared and tested all equipment, subsystems and systems in accordance with the requirements of the individual Specification Section and Section 46 00 00 – Equipment General Provisions to check its ability for sustained operation, including inspections and adjustments by Manufacturer's representative.

B. Contractor shall develop and submit schedule in accordance with this Section.

C. After the facilities are sufficiently complete to permit start-up, Contractor shall furnish licensed operator to start-up the facilities. Contractor will be responsible for startup of all facilities constructed under this Contract. During the initial start-up period the Contractor shall check and provide for mechanical operation in accordance with the Contract Documents.

3.02 FIELD QUALITY CONTROL

A. Manufacturers' Field Services:

1. When specified, furnish services of factory trained representatives of material and equipment manufacturers as specified, including supervising installation, adjusting, checkout, start-up, and testing of materials and equipment.

2. Certification:

a. When services by manufacturer are required at the Site, within 14 days after first test operation of equipment, submit to Engineer a letter from

manufacturer, on manufacturer's letterhead, stating that materials and equipment are installed in accordance with manufacturer's requirements and installation instructions, and in accordance with the Contract Documents.

b. Include in the final operations and maintenance manual for the associated equipment a copy of the letter or completed form, as applicable.

3. Manufacturer shall bring any discrepancies to the immediate attention of the Contractor for correction. Contractor shall promptly correct any discrepancies noted by the Manufacturer. Manufacturer shall coordinate correction of discrepancies with the Contractor. Discrepancies and their correction shall be noted in inspection records and in all required reports. Any corrections that result in changes to the work as shown on the Contract Documents shall be approved by the Engineer prior to their execution.

3.03 SYSTEM START-UP

A. Equipment and materials shall be provided in conformance with the manufacturer's installation instructions and in accordance with the Contract Documents.

B. Provide start-up services as specified in the individual Specification Sections.

C. Contractor shall furnish consumables required for startup including, but not limited to, electricity, water, chemicals and lubrication. Contractor shall provide a plan for disposal of water used for testing unless otherwise specified in the Contract Documents.

D. General system requirements:

1. Start-up of the plant by Contractor shall include all mechanical systems, including but not limited to, pumps, compressors, and like equipment, and the ventilating, air conditioning (or heating), plumbing, and electrical systems. Start-up of either the heating or air conditioning systems is dependent upon the time of year that the plant start up is initiated. Contractor will be required to return at the beginning of the next heating or air conditioning season (whichever is applicable) to start the appropriate system.

2. Cleaning as required under provisions of the Contract Documents.

3. Remove temporary protective coatings.

4. Flushing and replacing greases and lubricants as required by Manufacturer

5. Lubrication.

6. Verify the following:

a. Shaft and coupling alignments. Reset where needed.

b. Set motor, pump and other equipment rotation, safety interlocks, and belt tensions.

c. Leveling plates, grout, bearing plates, anchor bolts, fasteners, and alignment of piping, conduits and ducts that may apply stress on equipment.

7. Valves:

a. Tighten packing glands to ensure no leakage but allow valve stems to operate without galling.

b. Replace packing in valves to retain maximum adjustment after system is determined to be complete.

c. Replace packing on valves that continue to leak.

d. Remove and repair bonnets that leak.

e. After cleaning, coat packing gland threads and valve stems with surface preparation of “Molycote” or “Fel-Pro” or approved equal.

8. Verify that control valve seats are free of foreign matter and are properly positioned for intended service.

9. Tighten flanges and other pipe joints after system has been placed in operation.

10. Replace gaskets that show signs of leakage after tightening.

11. Inspect all joints for leakage:

a. Promptly remake each joint that appears to be faulty; do not wait for rust or other corrosion to form.

b. Clean threads on both parts and apply compound and remake joints.

12. After system has been placed in operation, clean valve seats and headers in fluid system to ensure freedom from foreign matter.

13. Remove rust, scale, and foreign matter from equipment and renew defaced surfaces.

14. Repair damaged insulation.

3.04 INITIAL START-UP

A. Prior to start-up of the facilities, the Contractor shall have prepared and tested all equipment in accordance with the requirements of the individual Specification Section and Section 46 00 00 – Equipment General Provisions, to check its ability for sustained operation, including inspections and adjustments by manufacturer's servicemen.

B. After the facilities are sufficiently complete to permit start-up, Contractor shall furnish licensed operator to start-up the facilities. Contractor will be responsible for start-up of all facilities constructed under this Contract. During the initial start-up period Contractor shall check and provide for satisfactory mechanical operation of the plant facilities. The manufacturer's representatives shall be present during this period to instruct the plant operators in the care, operation, and maintenance of the equipment.

C. Prior to start-up, Contractor shall prepare a schedule detailing the proposed start-up and his plans for manpower and auxiliary facilities to be provided. Plan shall indicate when and how much water will be used, and what methods the Contractor plans for disposal of the water. It is Contractor's responsibility to treat all water used for testing and start-up, to meet the regulatory agency requirements, and obtain all necessary permits, and to plan his activities so as not to exceed discharge limitations. The start-up schedule is subject to approval by Engineer.

D. Start-up of the plant by Contractor shall include all mechanical facilities such as pumps, compressors, and like equipment, and the ventilating, air conditioning (or heating), plumbing, and electrical systems. Start-up of either the heating or air conditioning systems is dependent upon the time of year that the plant start-up is initiated. Contractor will be required to return at the beginning of the next heating or air conditioning season (whichever is applicable) to start the appropriate system.

E. The permanent plant power service is required for testing and initial start-up. Contractor shall make all arrangements to provide this power service to the plant via the permanent electrical service facilities. Energy costs will be paid by the Owner.

F. When the start-up period is completed, Owner will assume responsibility for operation of the facilities, provided that Operation and Maintenance Manuals are approved and submitted, Owner personnel training in operation and maintenance has been satisfactorily completed, and all major items of the work are operating satisfactorily and the total system approved by Engineer. If any or all of the plant facilities are not operating satisfactorily at the end of the start-up period, Contractor shall continue to operate those facilities that are incomplete or not operating satisfactorily until they are complete and acceptable to Owner and Engineer.

END OF SECTION

SECTION 01 77 19
CLOSEOUT REQUIREMENTS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Substantial Completion.

2. Final inspection.

3. Request for final payment.

1.02 REFERENCES

A. Definitions:

1. Substantial completion procedures for requesting and documenting are in the General Contract Conditions, as modified by Special Contract Conditions.

2. Final inspection procedures for requesting and documenting are in the General Contract Conditions, as modified by Special Contract Conditions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Request for Final Payment:

1. Procedure: Submit request for final payment in accordance with the Contract and General Contract Conditions, as may be modified by the Special Contract Conditions.

B. Request for final payment shall include:

1. Documents required for progress payments in Section 01 29 76 – Progress Payment Procedures.

2. Documents required in the General Contract Conditions, as may be modified by the Special Contract Conditions.

3. Releases or Waivers of Lien Rights:

a. Provide a final release or waiver by Contractor and each Subcontractor and Supplier that provided Contractor with labor, material, or equipment totaling $10,000 or more.

b. Provide list of Subcontractors and Suppliers for which release or waiver of Lien is required.

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c. Each release or waiver of Lien shall be signed by an authorized representative of the entity submitting release or waiver to Contractor, and shall include Subcontractor's or Supplier's corporate seal, when applicable.

d. Release or waiver of Lien may be conditional upon receipt of final payment.

e. Manufacturer's Affidavit of Release of Liens – furnish a separate, completed form from the manufacturer.

4. Consent of Surety Company to Final Payment.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 78 23
OPERATIONS AND MAINTENANCE DATA

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: Requirements for operation and maintenance data, manuals, and documentation.

1. Submit operation and maintenance data, in accordance with this Section and in accordance with requirements elsewhere in the Contract Documents, as instructional and reference manuals by operations and maintenance personnel at the Site.

2. At minimum, submit operation and maintenance data for:

a. All equipment and systems

b. Valves, gates, actuators, and related accessories

c. Instrumentation and control devices

d. Electrical gear

3. For each operation and maintenance manual, submit the following:

a. Preliminary Submittal: Printed and bound copy of entire operation and maintenance manual or electronic copy, except for test data and service reports by Supplier.

b. Final Submittal: Printed and bound copy of complete operations and maintenance manual and electronic copy, including test data and service reports by Supplier.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Quantity Required and Timing of Submittals:

1. Preliminary Submittal:

a. Electronic Copies: One copy.

b. Submit to Engineer, whichever occurs first:

1) 60 days prior to starting training of operations and maintenance personnel.

2) 30 days prior to field quality control testing at the Site.

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c. Furnish preliminary operation and maintenance data submittal in acceptable form and content, as determined by Engineer, before associated materials and equipment will be eligible for payment.

2. Preliminary Submittal shall be reviewed by Engineer. One printed or electronic copy shall be returned to Contractor with required revisions noted.

3. Final Submittal: Provide 14 days prior to checkout and startup procedures specified in Section 01 75 00 – Checkout and Startup Procedures, unless Submittal is specified as required prior to an interim Milestone.

a. Printed Copies: Two copies.

b. Electronic Copies: One copy.

B. Format of Printed Copies:

1. Binding and Cover:

a. Bind each operation and maintenance manual in durable, permanent, stiff-cover binder(s), comprising one or more volumes per copy as required. Binders shall be minimum one-inch wide and maximum of three-inch wide. Binders for each copy of each volume shall be identical.

b. Provide the following information on cover of each volume:

1) Title: “OPERATING AND MAINTENANCE INSTRUCTIONS”.

2) Name or type of material or equipment covered in the manual.

3) Volume number, if more than one volume is required, listed as “Volume __ of __”, with appropriate volume-designating numbers filled in.

4) Name of Project and, if applicable, Contract name and number.

5) Name of building or structure, as applicable.

c. Provide the following information on spine of each volume:

1) Title: “OPERATING AND MAINTENANCE INSTRUCTIONS”.

2) Name or type of material or equipment covered in the manual.

3) Volume number, if more than one volume is required, listed as “Volume __ of __”, with appropriate volume-designating numbers filled in.

4) Project name and building or structure name.

2. Drawings:

a. Bind into the manual drawings, diagrams, and illustrations up to and including 11 inches by 17 inches in size, with reinforcing.

b. Documents larger than 11 inches by 17 inches shall be folded and inserted into clear plastic pockets bound into the manual. Mark pockets with printed text indicating content and drawing numbers. Include no more than three drawing sheets per pocket.

3. Copy Quality and Document Clarity:

a. Contents shall be original-quality copies. Documents in the manual shall be either original manufacturer-printed documents or first-generation photocopies indistinguishable from originals. If original is in color, copies shall be in color.

b. Clearly mark in ink to indicate all components of materials and equipment on catalog pages for ease of identification. In standard or pre-printed documents, indicate options furnished or cross out inapplicable content.

4. Organization:

a. Provide table of contents in each volume for each chapter or section.

b. Use dividers and indexed tabs between major categories of information, such as operating instructions, preventive maintenance instructions, and other major subdivisions of data in each manual.

C. Format of Electronic Copies:

1. Each electronic copy shall include all information included in the corresponding printed copy.

2. Submit electronic copy via transferable method and format acceptable to Engineer.

3. File Format:

a. Acceptable formats include Adobe PDF, Microsoft Word, Autodesk DWF, and AutoCAD.

b. Files shall be electronically searchable.

c. Submit separate file for each separate document in the printed copy.

d. Within each file, provide bookmarks for the following:

1) Each chapter and subsection listed in the corresponding printed copy document's table of contents

2) Each figure

3) Each table

4) Each appendix

4. Submit drawings and figures in one of the following formats: ".bmp", ".tif", ".jpg", ".gif", "dwf", or "dwg".

D. General Content Requirements:

1. Prepare each operations and maintenance manual specifically for the Project. Include in each manual all pertinent instructions, as-built drawings as applicable, bills of materials, technical bulletins, installation and handling requirements, maintenance and repair instructions, and other information required for complete, accurate, and comprehensive data for safe and proper operation, maintenance, and repair of materials and equipment furnished for the Project. Include in manuals specific information required in the Specification Section for the material or equipment, data required by Laws and Regulations, and data required by authorities having jurisdiction.

2. Submit complete, detailed written operating instructions for each material or equipment item including: function; operating characteristics; limiting conditions; operating instructions for start-up, normal and emergency conditions; regulation and control; operational troubleshooting; and shutdown. Also include, as applicable, written descriptions of alarms generated by equipment and proper responses to such alarm conditions.

3. Submit written explanations of all safety considerations relating to operation and maintenance procedures.

4. Submit complete, detailed, written preventive maintenance instructions including all information and instructions to keep materials, equipment, and systems properly lubricated, adjusted, and maintained so that materials,

equipment, and systems function economically throughout their expected service life. Instructions shall include:

a. Written explanations with illustrations for each preventive maintenance task such as inspection, adjustment, lubrication, calibration, and cleaning. Include pre-startup checklists for each equipment item and maintenance requirements for long-term shutdowns.

b. Recommended schedule for each preventive maintenance task.

c. Lubrication charts indicating recommended types of lubricants, frequency of application or change, and where each lubricant is to be used or applied.

d. Table of alternative lubricants.

e. Troubleshooting instructions.

f. List of required maintenance tools and equipment.

5. Submit complete bills of material or parts lists for materials and equipment furnished. Lists or bills of material may be furnished on a per-drawing or per-equipment assembly basis. Bills of material shall indicate:

a. Manufacturer’s name, address, telephone number, fax number, and Internet website address.

b. Manufacturer’s local service representative’s or local parts supplier’s name, address, telephone number, fax number, Internet website address, and e-mail addresses, when applicable.

c. Manufacturer’s shop order and serial number(s) for materials, equipment or assembly furnished.

d. For each part or piece include the following information:

1) Parts cross-reference number. Cross-reference number shall be used to identify the part on assembly drawings, Shop Drawings, or other type of graphic illustration where the part is clearly shown or indicated.

2) Part name or description.

3) Manufacturer’s part number.

4) Quantity of each part used in each assembly.

5) Current unit price of the part at the time the operations and maintenance manual is submitted. Price list shall be dated.

6. Submit complete instructions for ordering replaceable parts, including reference numbers (such as shop order number or serial number).

7. Submit manufacturer's recommended inventory levels for spare parts, extra stock materials, and consumable supplies for the initial two years of operation. Consumable supplies are items consumed or worn by operation of materials or equipment, and items used in maintaining the operation of material or equipment, including items such as lubricants, seals, reagents, and testing chemicals used for calibrating or operating the equipment. Include estimated delivery times, shelf life limitations, and special storage requirements.

8. Submit manufacturer's installation and operation bulletins, diagrams, schematics, and equipment cutaways. Where materials pertain to multiple models or types, mark the literature to indicate specific material or equipment supplied. Marking may be in the form of checking, arrows, or underlining to indicate pertinent information, or by crossing out or other means of obliterating information that does not apply to the materials and equipment furnished.

9. Submit original-quality copies of each approved and accepted Shop Drawing, product data, and other submittal, updated to indicate as-installed condition. Reduced drawings are acceptable only if reduction is to not less than one-half original size and all lines, dimensions, lettering, and text are completely legible on the reduction.

10. Submit complete electrical schematics and wiring diagrams, including complete point-to-point wiring and wiring numbers or colors between all terminal points.

11. Submit copy of warranty bond and service contract as applicable.

12. When copyrighted material is used in operations and maintenance manuals, obtain copyright holder's written permission to use such material in the operation and maintenance manual.

1.03 SUBMITTALS

A. Action/Informational Submittals: Submit preliminary schedule (listing) of operations and maintenance data for Engineer's review. Preliminary operations and maintenance data shall be grouped as major equipment and material systems and divided into sub-systems as required for clarity, subject to Engineer's approval.

B. Closeout Submittals:

1. Operation and maintenance data: Submit the operations and maintenance data indicated in the Contract Documents, grouped into submittals as approved by Engineer.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 SCHEDULE

A. Contractor shall furnish Operation & Maintenance Manuals for the systems and equipment, as required in the Specifications, in the time indicated in Article 1.02 of this Section.

END OF SECTION

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SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Requirements for recording changes to record documents.

2. Requirements for electronic files furnished by Engineer.

B. Contractor shall maintain and submit to Engineer with record documents in accordance with the Specifications, General Contract Conditions, and Special Contract Conditions.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Maintenance of Record Documents:

1. The following record documents shall be maintained in the Contractor's field office:

a. Drawings, Specifications, and Addenda.

b. Shop Drawings, Samples, and other Contractor submittals, including records of test results, approved or accepted as applicable, by Engineer.

c. Change Orders, Work Change Directives, Field Orders, photographic documentation, survey data, and all other documents pertinent to the Work.

2. Update record documents on a monthly basis, minimum.

3. Provide files and racks for proper storage and easy access to record documents.

4. Make record documents available for inspection upon request of Engineer or Owner.

5. Do not use record documents for purpose other than serving as Project record. Do not remove record documents from Contractor's field office without Engineer's approval.

B. Submittal of Record Documents:

1. Submit to Engineer the following record documents: Drawings.

2. Prior to readiness for final payment, submit to Engineer one copy of final record documents. Submit complete record documents; do not make partial submittals.

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3. Submit record documents with transmittal letter on contractor letterhead complying with letter of transmittal requirements in Section 01 33 00 – Submittal Procedures.

4. Record documents submittal shall include certification, with original signature of official authorized to execute legal agreements on behalf of Contractor.

C. Electronic Files Furnished by Engineer:

1. CADD files will be furnished by Engineer upon the following conditions:

a. Contractor shall submit to Engineer a letter on Contractor letterhead requesting CADD files and providing specific definition(s) or description(s) of how files will be used, and specific description of benefits to Owner (including credit proposal, if applicable) if the request is granted.

b. Contractor shall execute Engineer's standard agreement for release of electronic files and shall abide by all provisions of the agreement for release of electronic files.

c. Layering system incorporated in CADD files shall be maintained as transmitted by Engineer. CADD files transmitted by Engineer containing cross-referenced files shall not be bound by Contractor. Drawing cross-references and paths shall be maintained. If Contractor alters layers or cross-reference files, Contractor shall restore all layers and cross-references prior to submitting record documents to Engineer.

d. Contractor shall submit record drawings to Engineer in same CADD format that files were furnished to Contractor.

1.03 SUBMITTALS

A. Closeout Submittals: Provide record documentation as specified in this Section.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 GENERAL REQUIREMENTS:

A. At the start of the Project, label each record document to be submitted as, "PROJECT RECORD" using legible, printed letters. Letters on record copy of the Drawings shall be two inches high.

B. Keep record documents current. Make entries on record documents within two working days of receipt of information required to record the change.

C. Do not permanently conceal the Work until required information has been recorded.

D. Accuracy of record documents shall be such that future searches for items shown on the record documents may rely reasonably on information obtained from Engineer-accepted record documents.

E. Marking of Entries:

1. Use erasable, colored pencils (not ink or indelible pencil) for marking changes, revisions, additions, and deletions to record documents.

2. Clearly describe the change by graphic line and make notations as required. Use straight-edge to mark straight lines. Writing shall be legible and sufficiently dark to allow scanning of record documents into legible electronic files.

3. Date all entries on record documents.

4. Call attention to changes by drawing a “cloud” around the change(s) indicated.

5. Mark initial revisions in red. In the event of overlapping changes, use different colors for subsequent changes.

3.02 RECORDING CHANGES TO DRAWINGS:

A. Record changes on copy of the Drawings. Submittal of Contractor-originated or -produced drawings as a substitute for recording changes on the Drawings is unacceptable.

B. Record changes on plans, sections, schematics, and details as required for clarity, making reference dimensions and elevations (to Project datum) for complete record documentation.

C. Record actual construction including:

1. Depths of various elements of foundation relative to Project datum.

2. Field changes of dimensions, arrangements, and details.

3. Changes made in accordance with Change Orders, Work Change Directives, and Field Orders.

4. Changes in details on the Drawings. Submit additional details prepared by Contractor when required to document changes.

3.03 RECORDING CHANGES FOR SCHEMATIC LAYOUTS:

A. In some cases, on the Drawings, arrangements of conduits, circuits, piping, ducts, and similar items are shown schematically and are not intended to portray physical layout.

For such cases, the final physical arrangement shall be determined by Contractor subject to acceptance by Engineer.

B. Record on record documents all revisions to schematics on Drawings, including: piping schematics, ducting schematics, process and instrumentation diagrams, control and circuitry diagrams, electrical one-line diagrams, motor control center layouts, and other schematics when included in the Contract. Record actual locations of equipment, lighting fixtures, in-place grounding system, and other pertinent data.

C. When dimensioned plans and dimensioned sections on the Drawings show the Work schematically, indicate on the record documents, by dimensions accurate to within one inch in the field, centerline location of items of Work such as conduit, piping, ducts, and similar items

1. Clearly identify the Work item by accurate notations such as “cast iron drain”, “rigid electrical conduit”, “copper waterline”, and similar descriptions.

2. Show by symbol or note the vertical location of Work item; for example, “embedded in slab”, “under slab”, “in ceiling plenum”, “exposed”, and similar designations. For piping not embedded, also provide elevation dimension relative to Project datum.

3. Descriptions shall be sufficiently detailed to be related to Specifications.

D. Engineer may furnish written waiver of requirements relative to schematic layouts shown on plans and sections when, in Engineer’s judgment, dimensioned layouts of Work shown schematically will serve no useful purpose. Do not rely on waiver(s) being issued.

3.04 REQUIREMENTS FOR SUPPLEMENTAL DRAWINGS:

A. In some cases, drawings produced during construction by Engineer or Contractor supplement the Drawings and shall be included with record documents submitted by Contractor. Supplemental record drawings shall include drawings provided with Change Orders, Work Change Directives, and Field Orders and that cannot be incorporated into the Drawings due to space limitations.

B. Supplemental drawings provided with record drawings shall be integrated with the Drawings and include necessary cross-references between drawings. Supplemental record drawings shall be on sheets the same size as the Drawings.

C. When supplemental drawings developed by Contractor using computer-aided drafting/design (CADD) software are to be included in record drawings, submit electronic files for such drawings in AutoCAD (latest version) as part of record drawing submittal.

3.05 RECORDING CHANGES TO SPECIFICATIONS AND ADDENDA:

A. Mark each Section to record:

1. Manufacturer, trade name, catalog number, and Supplier of each product and item of equipment actually provided.

2. Changes made by Addendum, Change Orders, Work Change Directives, and Field Orders.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 01 78 43
SPARE PARTS AND EXTRA MATERIAL

PART 1 – GENERAL

1.01 SUMMARY

A. Contractor shall furnish spare parts data and extra materials for materials and equipment in accordance with the Contract Documents.

B. Spare Parts and Extra Materials:

1. Provide spare parts, extra stock materials, maintenance supplies, and special tools required for maintenance (“spare parts and extra materials”) for one year of operation (unless otherwise specified in the individual Specification Section).

    a. Provide Supplier recommended lubricating oil and grease in accordance with this Section and the Contract Documents.

2. Provide list of Supplier recommended spare parts and extra material.

    a. Include list of four standard lubricants, minimum, that shall be interchangeable for each type of lubricant required in the Contract Documents.

    b. Include unit prices in current United States funds.

    c. Source(s) of supply for each.

C. Packaging and Labeling:

1. Furnish spare parts and extra materials in manufacturer’s unopened cartons, boxes, crates, or other original, protective covering suitable for preventing corrosion and deterioration for maximum length of storage normally anticipated by manufacturer.

2. Packaging of spare parts and extra materials shall be clearly marked and identified with name of manufacturer, applicable equipment, part number, part description, and part location in the equipment.

3. Protect and package spare parts and extra materials for maximum shelf life normally anticipated by manufacturer.

D. Finishes: Spare parts and extra material shall have painting, protective coating, and finishes identical to original installed equipment and material. Where painting, protective coating, or finishes are not specified, suitable provisions shall be furnished to protect from corrosion.

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E. Special Tools: Contractor shall provide special tools necessary to operate, disassemble, service, repair, and adjust equipment and material in accordance with the manufacturer's operation and maintenance manual. Special tool requirements shall be the same as spare parts and extra material specified in this Section.

F. Storage Prior to Delivery to Owner: Prior to furnishing spare parts and extra materials to Owner, store spare parts and extra materials in accordance with the Contract Documents and manufacturers' recommendations.

G. Delivery Time and Eligibility for Payment:

1. Deliver to Owner spare parts and extra materials prior to date of Substantial Completion for equipment or system associated with the spare parts and extra materials. Do not deliver spare parts and extra materials before commencing start-up for associated equipment or system.

2. Spare parts and extra materials are not eligible for payment until delivered to Owner and Contractor's receipt of Owner's countersignature on letter of transmittal.

H. Procedure for Delivery to Owner:

1. Deliver spare parts and extra materials to Owner's permanent storage rooms at the Site or area(s) at the Site designated by Owner.

2. When spare parts and extra materials are delivered, Engineer and Owner will mutually inventory the spare parts and extra materials delivered to verify compliance with the Contract Documents regarding quantity and part numbers.

3. Additional procedures for delivering spare parts and extra materials to Owner, if required, will be developed by Engineer and complied with by Contractor.

I. Transfer Documentation:

1. Furnish on Contractor letterhead a letter of transmittal for spare parts and extra materials furnished under each Specification Section. Letter of transmittal shall accompany spare parts and extra materials. Do not furnish letter of transmittal separate from associated spare parts and extra materials.

2. Furnish three original, identical, signed letters of transmittal for each Specification Section. Upon delivery of specified quantities and types of spare parts and extra materials to Owner, designated person from Owner will countersign each original letter of transmittal indicating Owner's receipt of spare parts and extra materials.

a. Owner will retain one fully signed original.

b. Contractor shall submit one fully signed original to Engineer.

c. Contractor shall retain one fully signed original for Contractor's file.

3. Letter of transmittal shall include the following:

a. Information required for letters of transmittal in Section 01 33 00 – Submittal Procedures.

b. Transmittal shall list spare parts and extra materials furnished under each Specification Section. List each individual part or product and quantity furnished.

c. Provide space for countersignature by Owner as follows: space for signature, space for printed name, and date.

J. Contractor shall be fully responsible for loss or damage to spare parts and extra materials until spare parts and extra materials are received by Owner.

1.02 SUBMITTALS

A. Action/Informational Submittals: Individual Specification Sections that require spare parts, extra material, or tools, Contractor shall submit inventory checklist for each individual Specification Section that includes the following information:

1. Specification Section number and title.

2. Name of spare parts, extra material, or tools.

3. Manufacturer, part number and description.

4. Quantity specified and furnished.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 01 79 00
INSTRUCTION OF OWNER'S PERSONNEL

PART 1 – GENERAL

1.01 SUMMARY

A. Contractor shall furnish services of operation and maintenance training specialists to instruct Owner's personnel in recommended operation and maintenance procedures for materials and equipment furnished, in accordance with the Contract Documents.

B. Contractor shall provide a combination of classroom and field training at the Site, unless otherwise required elsewhere in the Contract Documents.

C. Owner reserves the right to record training sessions on video for Owner's later use in instructing Owner's personnel.

D. Owner may request additional training from the Engineer specific to process control of individual unit processes, overall treatment, regulatory compliance, residuals management and other aspects of water treatment specific to the raw water being treated. This training shall not replace any of the other training required to be performed by the Contractor as described in this Section.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Definitions:

1. Training – Manufacturer will provide verbal, visual, and written presentation of materials to Owner's staff to ensure that any Owner personnel undergoing training understand the Manufacturer's recommended procedures to properly operate and maintain the equipment and systems for the expected service life.

B. Qualifications:

1. Contractor's instructors shall be factory-trained by manufacturer of material or equipment.

2. Contractor's instructors shall be proficient and experienced in conducting training of type required.

3. Qualifications of instructors are subject to acceptance by Engineer. If Engineer does not accept qualifications of proposed instructor, Contractor will furnish services of replacement instructor with acceptable qualifications.

C. Scheduling:

1. General:

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a. Contractor shall coordinate training services with start-up and initial operation of materials and equipment on days and times, and in manner, acceptable to Owner, in accordance with the Contract Documents.

b. Training may be required outside of normal business hours to accommodate schedules of operations and maintenance personnel. Furnish training services at the required days and times at no additional cost to Owner.

c. Prerequisites to Training: Training of Owner's personnel shall commence after acceptable preliminary operation and maintenance data has been submitted and work required in Section 01 75 00 – Checkout and Startup Procedures is complete.

2. Training Schedule Submittal:

a. Training Schedule Required: Contractor shall prepare and submit proposed training schedule for review and acceptance by Engineer and Owner. Proposed training schedule shall show all training required in the Contract Documents, and shall demonstrate compliance with specified training requirements relative to number of hours of training, number of training sessions, and scheduling.

b. Timing of Training Schedule Submittal: Submit initial training schedule at least thirty days before scheduled start of first training session. Submit final training schedule, incorporating revisions in accordance with Engineer's comments, no later than seven days prior to starting the first training session.

c. Owner reserved the right to modify personnel availability for training in accordance with process or emergency needs at the Site.

D. Video Recording

1. Contractor shall provide a training specialist for a minimum of three (3) days, for each item of equipment specified, to meet with the Engineer to prepare training scripts and to participate in video recording of training. Video recorded training sessions shall be conducted separately from training sessions held for the Owner's personnel.

2. Manufacturer shall have the ownership rights to one unedited and one edited copy of the video recorded training.

3. As an alternative to video recording training at the Site, the Manufacturer may submit pre-recorded digital media covering the equipment supplied for approval. Submitted pre-recorded digital media shall meet the intent of this Section for approval consideration. If approved, Owner shall have the right to permanent ownership and use of at least one complete copy.

1.03 TRAINING REQUIREMENTS

A. General Lesson Plan Requirements:

1. Contractor's lesson plan shall describe specific instruction topics, system components for which training will be furnished, and training procedures. Handouts, if any, to be used in training shall be included with the lesson plan. Describe in lesson plan "hands-on" demonstrations planned for training sessions.

2. Lesson plan shall be approved a minimum of 30 days prior to starting associated training.

3. Lesson plan shall include estimated duration of each training segment.

B. Specific Lesson Plans Requirements:

1. Equipment overview shall cover the following:

a. Equipment's operating (process) function, performance objectives, and fundamental operating principles.

b. Equipment's mechanical, electrical, and electronic components and features. Group related components into subsystems and describe function of subsystem and subsystem's interaction with other subsystems.

c. Support equipment and appurtenances.

d. Safety and potential hazards.

e. Safety and control interlocks.

2. Operations personnel training shall cover the following:

a. Equipment overview: As described in this Section.

b. Operation:

1) Principles, operating, start-up, and shutdown procedures.

2) Abnormal or emergency start-up, operating, and shutdown procedures.

3) Alarm conditions and responses.

4) Monitoring and recordkeeping.

5) Housekeeping.

c. Troubleshooting: Required corrective maintenance or an operating parameter adjustment.

3. Maintenance personnel training:

a. Equipment overview: As described in this Section.

b. Equipment preventive maintenance:

1) Inspection procedures:

a) Operation.

b) Trouble symptoms and anticipate breakdowns.

c) Predictive maintenance.

2) Preventative maintenance intervals.

3) Lubricant and replacement parts.

4) Cleaning practices and intervals.

5) Special tools required.

6) Removal, installation, and disassembly and assembly procedures.

7) "Hands-on" demonstrations of preventive maintenance procedures.

8) Measuring instruments and procedures

9) Torqueing, mounting, calibrating, and aligning procedures and settings requirements.

10) Check and test equipment following corrective maintenance.

4. Equipment Troubleshooting:

a. Systematic troubleshooting procedures.

b. Checklists.

c. Testing and diagnostic procedures.

d. Corrective maintenance procedures with "hands on" demonstrations.

C. Training Aids:

1. Contractor's instructor shall incorporate training aids as appropriate to assist in the instruction. Provide handouts of text, tables, graphs, and illustrations as required. Other appropriate training aids include:

    a. Audio-visual aids

    b. Equipment cutaways and samples

    c. Tools, including special tools

2. Podium presentation aids: Presentation shall cover equipment, products and materials provided. Provide electronic version of presentation material to Engineer.

    a. Electronic version of presentation aids shall be Microsoft PowerPoint or equivalent format.

    b. Presentation shall include the following sections:

        1) Complete system overview including, but not limited to, related and associated equipment specific to the system.

        2) Specific equipment requirements and how equipment functions within the overall system.

        3) Site specific system and equipment requirements.

    c. Hardcopy handouts of the electronic presentation aids shall be provided prior to each training section for review during podium presentation.

3. Handouts:

    a. Contractor's instructor shall distribute and use descriptive handouts during training.

    b. Handouts should be coordinated with the instruction

    c. Provide at least ten copies of handouts for each training session

4. Audio-visual Equipment: Training provider shall provide audio-visual equipment required for training sessions.

1.04 SUBMITTALS

A. Action/Informational Submittals:

1. Training Schedule: Detailed schedule of training sessions, demonstrating compliance with number of training sessions, hours required in the Contract

Documents, and complying with the Contract Times. Submit training schedule submittals in accordance with timeframes specified in this Section.

2. Lesson Plan: Acceptable lesson plan for training on each material or equipment item, in accordance with the Contract Documents. Lesson plan shall comply with requirements of this Section. Include with lesson plan copy of handouts that will be used during training sessions. Provide lesson plan submittals in accordance with timeframes specified in this Section.

3. Podium presentation material, electronic version.

4. Qualifications: Credentials of Contractor's proposed operations and maintenance instructor(s). Credentials shall demonstrate compliance with requirements of this Section and shall include brief resume and specific details of instructor's operating, maintenance, and training experience relative to the specific material and equipment for which instructor will provide training.

B. Closeout Submittals:

1. Trainee sign-in sheet for each training session. Submit to Owner's training coordinator.

C. Quality Assurance Submittals:

1. Qualifications: Credentials of Contractor's proposed operations and maintenance instructor(s). Credentials shall demonstrate compliance with requirements of this Section and shall include brief resume' and specific details of instructor's operating, maintenance, and training experience relative to the specific material and equipment for which instructor will provide training.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 "HANDS-ON" DEMONSTRATIONS

A. Contractor's instructor shall provide "hands-on" demonstration of operations and maintenance of equipment and materials for each training session.

B. Contractor shall furnish tools and appurtenances required for demonstrations.

3.02 SCHEDULE

A. Contractor shall furnish the hours of training and number of sessions indicated, at a minimum. Travel time and expenses are the responsibility of the manufacturer and are excluded from required training time indicated in the Contract Documents.

B. Owner's operations at the Site occur 24 hours per day, divided into three shifts. Training shall be scheduled during day shift, normal working hours unless otherwise approved by Engineer.

C. Training shall be provided for a minimum of two identical sessions, unless otherwise specified, with each session scheduled for different weeks.

D. Contractor shall furnish training for the systems and equipment, as required in the Specifications.

END OF SECTION

SECTION 01 79 00

INSTRUCTION OF OWNER'S PERSONNEL

NO TEXT ON THIS PAGE

SECTION 02 24 20

SOIL SAMPLING AND ANALYSIS

PART 1 – GENERAL

1.01 SUMMARY

A. The Contractor shall provide all labor, materials, tools, and equipment to perform all operations necessary to characterize, classify and determine the requirements for handling, offsite reuse and disposal of all materials to be excavated.

B. Soil sampling results from the Design Phase soil sampling investigation are provided in Tables 1 through 4 provided at the end of this Section.

C. The primary method of characterizing soils for offsite reuse/disposal shall be through in-situ sampling. No stockpiling of excavated material on-site or ex-situ sampling will be allowed without written approval from the Engineer.

D. Related Sections

1. Section 01 35 45 – Hazardous Materials Control

2. Section 01 74 00 – Cleaning and Waste Management

3. Section 31 00 01 – Earthwork

4. Section 31 23 19 – Dewatering

5. Section 31 25 00 – Erosion and Sedimentation Control

1.02 REFERENCES

A. Definitions

1. Analyte-free Water: Water containing less than the detection limits for volatile organics, pesticides, PCBs and inorganics. Compliance shall be verified either by the supplier or by an analytical laboratory.

2. Case-Specific Beneficial Use Determination (BUD): Under 6 NYCRR Part 360, Section 360.12(d), NYSDEC sets forth the requirements for petitioning NYSDEC to obtain a Case-Specific BUD, and the criteria for reviewing, granting, or denying of the BUD. For reuse of a solid waste to be determined a beneficial use, the petition must satisfy all criteria outlined under 6 NYCRR Part 360, Section 360.12(d).

3. Composite Sample: Composite sampling is comprised of grab samples which are initially collected from within a grid area and then combined into a single sample. This sample is representative of the entire grid area from which the grab samples were collected.

4. Excavated Material: All material regardless of its nature, except rock or boulders that have been excavated. Refer to Section 31 00 01 – Earthwork.

5. Ex-situ Soil Sampling: Sampling of soil that has been excavated and stockpiled.

6. Fill: Soil and similar material excavated or brought to the Project Site for the purposes of construction. All fill material must meet the requirements of Section 31 00 01 – Earthwork. Fill from an off-site source shall be non-hazardous.

7. Grab/Discrete Sample: A single sample is collected at a particular time and place that represents the composition of the soil only at that time and place.

8. In-situ Soil Sampling: Sampling of soil prior to excavation and most representative of undisturbed conditions.

9. Pre-Determined Beneficial Use for fill material: Under 6 NYCRR Part 360, Section 360.13(b) Waste cessation. “Fill material ceases to be solid waste in accordance with the following:

    a. Restricted-use fill and limited-use fill – once delivered to the site of reuse;

    b. General fill generated outside of the City of New York – once a determination that it is general fill has been made;

    c. Under 6 NYCRR Part 360, Section 360.13 (c), Exemption for on-site reuse of fill material. “Fill material used as backfill for the excavation from which the fill material was taken, or as fill in areas of similar physical characteristics on the project property is exempt from regulation” under 6 NYCRR Part 360. “If fill material exhibits historical or visual evidence of contamination (including odors), and will be used in an area with public access, the relocated fill material must be covered with a minimum of 12 inches of soil or fill material that meets the criteria for general fill, as defined in” Section 360.13, Special requirements for pre-determined beneficial use of fill material.

10. Qualified Environmental Professional (QEP): “a person who possesses sufficient specific education, training, and experience necessary to exercise professional judgment to develop opinions and conclusions regarding the presence of releases or threatened releases to the surface or subsurface of a property or off-site areas, sufficient to meet the objectives and performance factors for the areas of practice identified” in 6 NYCRR Part 360, Section 360.2(b)(213).

11. Treatment, Storage, Disposal Facilities (TSDF): Includes, but is not limited to, all permitted facilities that treat, store, or manage disposal of regulated waste.

12. Waste Classification:

    a. Regulated Solid Waste:

        1) Construction and Demolition (C&D) Debris: Waste resulting from the construction, remodeling, repair and demolition of structures, buildings and roads. Such waste includes fill material, demolition wastes, and construction wastes. Materials that are not C&D debris (even if generated from construction, remodeling, repair, and demolition activities) include municipal solid waste, friable asbestos-containing waste, corrugated container board, electrical fixtures containing hazardous liquids such as fluorescent light ballasts or transformers, fluorescent lights, furniture, appliances, tires, drums, fuel tanks, containers greater than 10 gallons in size, and any containers having more than one inch of residue remaining on the bottom.

        2) Hazardous Solid Waste: Material shall be considered a characteristic hazardous solid waste when it exhibits any of the following: ignitability, corrosivity, reactivity, or toxicity for Volatile Organic Compounds (VOCs), semi-VOCs (SVOCs), metals, pesticides, or herbicides, as defined in 6 NYCRR Part 371 or 40 CFR Section 261. Under New York State (NYS) regulations, a material that contains 50 ppm or greater of PCBs is considered a hazardous waste. The Environmental Protection Agency (EPA) considers a material that contains 50 ppm or greater of PCBs to be a Toxic Substances Control Act (TSCA)-regulated waste. All hazardous waste shall be considered unsuitable for reuse and shall be disposed of at an approved permitted hazardous waste landfill.

        3) Non-Hazardous Contaminated Waste: Non-hazardous contaminated waste includes soil commingled with or containing other waste, petroleum and petroleum products, except those present solely as a result of normal use of vehicles on roadways or parking areas, and pesticides except those present solely as a result of the proper application in normal agricultural or horticultural practices. Physical evidence that soil is contaminated shall include visual identification of waste, chemical odors, vapor emission, and chemical staining.

        4) Non-hazardous Petroleum-contaminated Waste: Exhibits a discernible petroleum-type odor, contains visible petroleum product, or may be associated with a reported spill.

b. Non-regulated Solid Waste: This applies to materials that, before being beneficially used (as determined by the NYSDEC or applicable out-of-state regulatory agency) were solid waste. Material used as described in 6 NYCRR Part 360, specifically Section 360.12(c) and Section 360.12(d) is no longer considered solid waste.

B. Reference Standards

1. EPA QA/G-4, Guidance on Systematic Planning Using the Data Quality Objectives Process, February 2006 or latest revision

2. USEPA Office of Solid Waste, Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods (SW-846), Third Edition, December 1996 with updates or latest revision

3. USEPA 40 CFR Chapter I, Subchapter R, - Toxic Substance Control Act (TSCA), Part 761 Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions

4. NYSDEC regulations, 6 NYCRR Part 360, Solid Waste Management Facilities General Requirements

5. NYSDEC regulations, 6 NYCRR Part 371, Identification and Listing of Hazardous Wastes (40 CFR Part 261)

6. NYSDEC regulations, 6 NYCRR Part 375, Environmental Remediation Programs

7. American Society for Testing and Materials (ASTM) Standards:

a. D422 – Method for Particle-Size Analysis of Soils.

b. D1556 – Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

c. D1557 – Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))

d. D6938 – Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.03 DESCRIPTION

A. Sampling Requirements

1. Fill Material:

a. Material to be excavated and proposed for reuse as fill under a Pre-Determined Beneficial Use must meet the requirements of 6 NYCRR Part 360, Section 360.13(a), Applicability, Section 360.13(b), Waste Cessation, or Section 360.13(c), Exemption for On-site Reuse of Fill Material. If these criteria cannot be met, such material must meet Section 360.12(d), Case-specific beneficial use determinations - general.

b. Sampling for offsite reuse/disposal shall be required. Excavated soils shall be sampled in-situ for Resource Conservation and Recovery Act (RCRA) characteristics, including ignitability, corrosivity, reactivity, and Toxicity Characteristic Leaching Procedure (TCLP) for metals, SVOCs, VOCs, pesticides and herbicides.

c. When reused in New York State, excavated material samples shall be analyzed for, at a minimum, metals, PCBs/pesticides, and SVOCs as listed in 6 NYCRR Part 375, Subdivision 375-6.8(b) per 6 NYCRR Part 360.13(e)(2)(i). In addition, and only if site conditions warrant, fill material shall also be analyzed for additional parameters as referenced in Part 360.13(e)(2)(ii-iv).

d. Sampling is performed within the planned excavation boundaries at frequencies as defined in 6 NYCRR Part 360, Section 360.13(e)(1), Table 1: Minimum Analysis Frequency for Fill Material, unless otherwise required by the beneficial use facility or treatment, storage, and disposal facility (TSDF).

e. Analytical data is used to determine acceptable fill material uses (general fill, restricted-use fill, and limited-use fill), as defined in 6 NYCRR Part 360, Section 360.13(f), Table 2: Fill Material Beneficial Use.

f. If it is determined by the Contractor’s QEP during construction that soils cannot be reused in New York State, additional sampling shall be performed to meet the out-of-state beneficial use facility/TSDF requirements.

B. Off-Site Beneficial Use Facility/TSDF

1. The Contractor shall submit the name(s) of the selected off-site soil beneficial use facilities/TSDFs and their location(s) to the Engineer for approval as part of the Soil Excavation, Treatment Reuse, and Disposal Plan specified in Section 31 00 01 – Earthwork.

2. Reuse of excavation spoils off-site must be prioritized over disposal. TSDFs shall only be approved where reuse options are not available.

3. Note that some companies may have multiple beneficial use facilities or TSDFs, each possessing differing requirements regarding the types of

materials accepted, the specific analytical testing parameters that must be performed for each material, and the frequency of sampling required for each material. It is the Contractor's responsibility to determine the types of materials accepted, specific waste acceptance criteria (analytical parameters) and frequency of testing requirements for each of its proposed facilities.

4. The Contractor shall confirm the location(s) and permit status, as well as check for outstanding violations and enforcement actions at each selected beneficial use facility/TSDF. The Engineer shall verify the information provided by the Contractor for each facility prior to approval.

5. If an approved facility is not available during construction, the Contractor shall be fully responsible for procuring alternate approved facilities at no additional cost to the Owner. Any additional sampling and analysis required, and labor involved in selecting new facilities after the initial reuse or disposal facilities are accepted shall be the responsibility of the Contractor.

C. Project Conditions

1. Stockpiling: No stockpiling of excavated material on-site or ex-situ sampling of excavated soils will be allowed without written approval from the Engineer. If stockpiling is considered necessary, and approved by the Engineer, sampling shall be conducted by collecting representative grab samples throughout the soil stockpile. Surface soil shall not be used as sampling material. Sampling frequency and analytical requirements will at a minimum conform to the sampling requirements specified herein. Multiple samples shall be classified based on biased worst case to be considered fully representative of the soils being sampled for reuse in New York State. The Contractor is also required to satisfy the specific sampling requirements of the beneficial use facility or TSDF.

2. During stockpiling activities, the Engineer may identify quantities within each 300 cubic yard portion that differ in appearance from the bulk of the material as per 6 NYCRR Part 360, Section 360.13(e)(1) Table 1. In this case, the Engineer will direct the Contractor to segregate these variable materials for separate stockpiling on-site. The Contractor shall sample each stockpile that differs in appearance from the bulk of the material.

3. All stockpiles of excavated materials shall be managed on site as required in Section 31 25 00 – Erosion and Sedimentation Control.

D. Decontamination of Sampling Equipment: All sampling equipment shall be certified clean or precleaned, prior to collection of each sample, by the following method:

1. Wash all sampling equipment, secondary containers (e.g., mixing bowls for composite sampling) and aluminum foil with non-phosphate laboratory grade detergent and distilled water.

2. Triple rinse with distilled water.

3. Rinse with isopropyl alcohol, or if samples are visibly contaminated with petroleum use a solvent, such as hexane or other alternate approved by the Engineer.

4. Triple rinse with analyte-free water.

5. Disposal of Decontamination Solutions: Collect all decontamination solution and dispose of it through a licensed chemical waste disposal service if unsuitable for treatment on-site by incorporation into existing on-site treatment processes as defined in Section 31 23 19 – Dewatering.

1.04 QUALITY ASSURANCE

A. Laboratory Requirements:

1. The Contractor shall provide the services of a laboratory certified by the New York State Department of Health Environmental Laboratory Approval Program (NYSDOH-ELAP) to perform applicable testing and chemical analyses for the duration of the Work.

2. The laboratory shall also meet the certification requirements of the beneficial use facility/TSDF that will be utilized by the Contractor for the duration of the Work.

B. Permits and Regulations:

1. The Contractor shall obtain all necessary permits and perform all work in compliance with applicable requirements of OSHA, and other governing authorities having jurisdiction including all federal, state and local governing authorities.

C. Field QA/QC Samples:

1. Shall be collected and analyzed in accordance with the protocol for site samples.

2. The number of QA/QC samples required for a quantity of soil shall meet all beneficial use facility/TSDF requirements, and the approval of the Engineer.

D. Sample Turn-Around: The Contractor shall provide for prompt sampling and turn-around of analysis so as not to delay the project. If a turn-around time of less than

ten (10) business days is required due to delays in construction scheduling or other constraints, Contractor shall provide for such at no additional cost to the Owner.

1.05 SUBMITTALS

A. The Contractor shall submit Shop Drawings and other materials, including, but not limited to, those listed below for the approval of the Engineer. Where the Contractor's QEP determines that no sampling is required, at a minimum a Field Sampling Plan per Article 1.05.A.1 of this Section shall be submitted.

1. Field Sampling Plan (FSP): A FSP, prepared by the Contractor's QEP, shall be submitted to the Engineer for approval 30 days following notice to proceed. The Engineer will approve the FSP only if it clearly provides a means to collect the information necessary to allow for classification of all material proposed for excavation and if it will ultimately generate data necessary to gain approval from the Contractor's chosen off-site beneficial use facility/TSDF. No sampling shall be conducted until the Engineer has reviewed and formally approved the FSP in writing. The FSP shall include the following at a minimum:

   a. Locations and protocols for the collection and analysis of samples that represent all soils to be excavated. Collection methods and chosen locations shall be sufficient to pre-characterize the soil prior to excavation unless post-excavation sampling is approved by the Owner

   b. Each in-situ composite sample will be comprised of multiple (3-5) discrete samples that are representative of the horizontal and vertical extent of the excavation footprint.

      1) VOC analysis requires, two (2) discrete (biased worst case) VOC samples to be collected for every one (1) composite sample.

      2) When soils are visibly heterogenous, composite and discrete (for VOCs), samples will be obtained to represent each visually different stratum or section of the excavation site, regardless of the overall excavation volume.

   c. A detailed outline of the BUD or beneficial use facility/TSDF requirements for sampling, testing and analysis including specific number and types of samples per unit volume of soil to be excavated.

   d. Parameters analyzed for soils to be reused or disposed, as defined in 6 NYCRR Part 360, Section 360.13 (e), in addition to any other parameters required by the beneficial use facility/TSDF.

   e. A scaled site map showing:

      1) existing fixed landmarks;

2) proposed excavation limits or area to be excavated divided into distinct vertical and horizontal grids, identifying the volume of soil or fill that each sample will represent;

3) specific sampling locations that are representative of the entire depth of excavation and that will conform to the applicable sampling frequency requirement;

4) identification numbers of the sample grids, relative depth, sampling intervals, and volumes reflective of the Contractor's excavation method.

a) Sampling intervals shall account for existing subsurface data, historic sampling information, including descriptions, depths, orientation, and location of material of potentially different classifications, and shall minimize undue mixing of excavated soils.

f. Proposed sampling, handling, preservation, and storage of equipment procedures, including transfer procedures, and sampling equipment decontamination procedures.

g. Proposed analytical methods, in accordance with SW-846, latest edition, for the analyses to be performed. Contractor shall confirm the analytical method and laboratory selected is accepted/certified by the receiving facility, including beneficial use facility/TSDF, meets the regulatory requirements, and can meet the required reporting limits for comparison to beneficial use facility/TSDF accepting criteria and other limits, as applicable.

h. Procedures for assessing precision, accuracy, degree of representation, comparability and completeness of samples and data, including performance audits and proposed protocols for corrective measures where problems are identified in accordance with Article 1.04 of this Section.

i. Schedule of field inspections.

j. A statement that the sampling program is in accordance with the Contract requirements.

k. Manufacturer, catalog data and calibration records of all analytical equipment to be used on-site.

l. Name and address of analytical laboratory, copy of laboratory certification, and Quality Assurance Manual.

m. Description of field and laboratory QA/QC samples and any additional requirements of the reuse or disposal facilities.

n. The organizational structure of the Contractor's and all subcontractors' quality management (QM) personnel, including:

1) names, titles and contact information;

2) resumes;

3) responsibilities;

4) authorities; and

5) qualifications.

2. Field Sampling Summary Report (FSSR): A FSSR, prepared by the Contractor's QEP, shall be submitted to the Engineer for review in a timeframe, dependent on the extent of the data collection effort, determined by the Engineer at the time. Contractor shall be solely responsible for ensuring that the FSSR meets all requirements of Contractor's proposed beneficial use facility/TSDF. The FSSR shall contain all laboratory analytical results obtained from the field sampling event and shall allow the Engineer to determine if the soil is acceptable for beneficial use or requires disposal at a permitted TSDF. At minimum, the FSSR shall include the following information:

a. A detailed account of any field procedures used which deviated from or were in addition to those established in the FSP.

b. A summary table listing the analytical results (with individual ID for each sample) with highlighted exceedances of 6 NYCRR Part 360, Section 360.13 (f), Table 2: Fill Material Beneficial Use, all Beneficial Use Facility/TSDF acceptance criteria, RCRA characteristics, and any other screening criteria identified and approved by the Engineer during the Project, as applicable.

c. Location of each sampling point (using individual ID from analytical results summary table) on the scaled site map created in the FSP.

d. A complete set of field notes collected and maintained by the Contractor during sampling. The field notes shall be made available to the Engineer during the sampling program.

e. Boring or probe logs from each sampling location containing a continuous stratigraphic description of all material encountered. Descriptions of material shall include, but not be limited to, color, odor,

staining, field screening measurement, relative grain size distribution, material composition, moisture content, and cohesive properties.

f. Depth intervals for each sample, whether a grab or composite, and any special notes, which are included on the laboratory chain-of-custody forms.

g. Copies of all laboratory chain-of-custody forms for samples that are collected for analysis.

h. Analytical Results: The Contractor shall submit analytical results for sampled soil material to the Engineer within three (3) business days of receiving such data from the laboratory. Analytical results data shall be managed by utilizing a computer spreadsheet or database program compatible with NYSDEC requirements for EQuIS submittals as approved by the Engineer. Data shall be organized in such a way that all samples may be tracked from collection through analysis.

1) The analytical results generated for a ten (10) business day turn-around time deliverable shall include a Form I (or equivalent) showing compounds analyzed for, and concentrations detected, and associated chain-of-custody reports to the Engineer.

2) The final data package generated by the laboratory shall include the following information:

a) A Form I showing pertinent physical data presented in concise, easy to follow formats (i.e., sample number, laboratory ID, client, date of sample preparation, date analyzed, percent moisture, dilution factor, sample matrix, units, undetected and detected compounds, etc.).

b) Reference to analytical methodology used.

c) General discussion including a description of sample types, tests performed, any problems encountered, and any general comments (case narrative).

d) Data from each discrete sample reported using cross-referencing between site samples and quality control samples and including all pertinent dates, information and reporting limits.

e) Associated quality control samples such as blanks, spikes and spike duplicates, laboratory duplicates,

laboratory control samples, field duplicates and appropriate check standards.

f) Copies of chain-of-custody sheets.

3) The information must be delivered on CD or via electronic mail to the Engineer. All electronic data must be certified to be virus-free.

B. Monthly Submittals: Monthly soil generation/diversion (on site and off site reuse)/disposal data shall be tracked in accordance with Section 01 74 00 – Cleaning and Waste Management.

C. Coordinate all submittals with the Soil Excavation, Reuse, Transport and Disposal Plan (SERTD Plan) required in Section 31 25 00 – Earthwork.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Sample Identification:

1. All samples shall be identified with a sample label in addition to an entry on a chain-of-custody record. The label shall be identified upon receipt by the laboratory and cross-referenced to the chain-of-custody record.

2. Any inconsistencies shall be noted on the custody record. Laboratory personnel shall notify the QEP and/or Sampling and Analysis Manager immediately if any inconsistencies exist in the paper work associated with the samples, and Contractor shall collect new samples to replace those with inconsistencies which cannot be rectified.

B. Sample Labels: The field team shall complete the following information on a sample label for each sample bottle:

1. Site Name

2. Job Number

3. Sample Number

4. Sample Description

5. Company Name

6. Parameters to be analyzed

7. Date

8. Time

9. Preservation Technique Employed

10. Sample labels shall be attached to the sample bottles

C. Completion of Chain-of-Custody Record:

1. Maintain a chain-of-custody record on all samples. A chain-of-custody record is a printed multi-part form that accompanies a sample or group of samples as custody is transferred from person to person. A chain-of-custody record is a controlled document.

2. As soon as is practical after sample collection, preferably after decontamination, the following information shall be entered on the chain-of-custody form. All information shall be recorded in ink.

a. Project number: Enter the alphanumeric designation assigned by the field team that uniquely identifies the project site.

b. Project name: Enter the site name.

c. Samplers: Sign the name(s) of the sampler(s).

d. Station number: Enter the sample number for each sample in the shipment. This number appears on the sample identification label.

e. Date: Enter a six-digit number indicating the year, month, and day of sample collection.

f. Time: Enter a four-digit number indicating the time of collection in 24-hour time, for example, 13:54.

g. Matrix/Type: Indicate the type of sample; composite or grab.

h. Station location: Describe the location where the sample was collected.

i. Number of containers: For each sample number, enter the number of sample bottles that are contained in the shipment.

j. Remarks: Enter any appropriate remarks.

k. Sample Shipment:

3. Custody of samples shall be maintained throughout the shipment of samples to the selected laboratory (ies). All samples shall be packaged and shipped daily to ensure that no sample is held at the site more than 24 hours. Samples shall be delivered directly to the laboratory using the following procedures:

a. Use waterproof high-strength plastic ice chests or coolers only.

b. After filling out the pertinent information on the sample label and tag, put the sample in the bottle or vial and screw on the lid. For bottles other than VOC sample bottles, secure the lid with tape (tape on VOC bottles may cause contamination).

c. Place inert cushioning material such as vermiculite or "bubble-wrap" in the bottom of the cooler.

d. Enclose the bottles in clear plastic bags through which sample labels are visible, and seal the bag. Place bottles upright in the cooler in such a way that they do not touch and will not touch during shipment.

e. Put in additional inert packing material to partially cover sample bottles (more than half-way). Place double-bagged crushed ice around, among, and on top of the sample bottles.

f. Fill cooler with cushioning material.

g. Put paperwork (chain-of-custody record) in a waterproof plastic bag and tape it with packing tape to the inside lid of the cooler.

h. Tape the drain shut.

i. Secure lid by taping. Wrap the cooler completely with strapping tape at a minimum of two locations. Do not cover any labels.

j. Attach completed shipping label to top of the cooler.

k. Put "This Side Up" labels on all four sides and "Fragile" labels on at least two sides of coolers containing glass containers.

l. Ship the cooler overnight by commercial carrier (e.g., Federal Express, UPS), laboratory carrier or field personnel to the respective laboratory.

m. Custody forms for the samples shall be signed by the Contractor's designated representative who is relinquishing custody. The custody form shall include the air bill number, method of shipment, and time and date of the transfer of custody.

4. Custody seals shall be applied to the front and back of the sample coolers. A shipping label with return address shall be applied as well as the air express bill and any Department of Transportation (DOT) required labels or markings.

D. Transferring Custody of Samples to Shipper, if applicable: Contractor shall transfer custody of samples to a shipper as follows:

1. Sign, date, and enter time on the chain-of-custody report under "Relinquished by."

2. Make certain that shipper signs the "Received by" entry.

3. Enter name of the carrier under next "Relinquished by" category. Receiving laboratory shall sign "Received for Laboratory by" on lower line and enter date and time.

E. Transferring Custody from Sampler or Shipper to Common Carrier:

1. The shipper or Contractor shall transfer custody of samples to a common carrier as follows:

a. Sign, date, and enter time under "Relinquished by" entry.

b. Enter name of carrier (e.g., UPS, Federal Express) under "Received by."

c. Enter bill-of-lading or Federal Express airbill number under "Remarks."

d. Place the original of the chain-of-custody form in the appropriate sample shipping package. Retain a copy with field records.

e. Sign and date the custody seal. The custody seal is part of the chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field.

f. Wrap the seal across filament tape which has been wrapped around the hinges of the shipping package at least twice.

g. Fold the custody seal over on itself so that it sticks together.

h. Complete other carrier-required shipping papers.

i. In instances when the Common Carrier will not accept responsibility for handling chain-of-custody forms, the Contractor shall ensure that the record is packed within the sample package.

F. Laboratory Custody Procedures: Once the samples arrive at the laboratory, the Contractor shall ensure that custody of the samples is maintained by laboratory personnel. The laboratory shall, at a minimum, document the chain of custody through each stage of analysis from receipt to final reporting.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 EXAMINATION / PREPARATION

A. Testing shall be in accordance with the sampling requirements of Article 1.03.A of this Section.

1. Parameters analyzed for soils to be reused or disposed off-site shall be the RCRA characteristics, including ignitability, corrosivity, reactivity, and Toxicity Characteristic Leaching Procedure (TCLP) for metals, SVOCs, VOCs, and pesticides and herbicides, in addition to any other parameters required by the beneficial use facility or TSDF.

a. If any soil sample results are greater than 5 ppm lead by TCLP the Contractor shall immediately notify the Engineer. (See Section 01 35 45 – Hazardous Materials Control for implementation of a Community Air Monitoring Program (CAMP) in the event that hazardous levels of lead are detected in soil.)

B. Field sampling shall be completed in ample time to prevent delay of the excavation work or the work of any other contractor.

3.02 IMPLEMENTATION

A. When relocating soils on the same Site, hazardous soils, non-soil wastes, or hot spots, as evidenced by visual observation, hand-held instruments or analytical results, must not be incorporated. All such material shall be removed off-site for proper disposal, treatment, and/or reuse as applicable.

3.03 FIELD TESTING / QUALITY CONTROL

A. Sampling frequencies shall be per Article 1.03.A of this Section.

B. Classification of soils for offsite reuse or disposal shall be carried out by the Engineer.

C. Conduct testing in accordance with the approved FSP.

D. Calibrate all instruments in accordance with manufacturer recommendations.

END OF SECTION

TABLE 1: SUMMARY OF ANALYSIS ON COMPOSITE SOIL SAMPLES

Sample ID		NYSDEC Part 375 Restricted Use Soil Cleanup Objectives-Residential	NYSDEC Part 375 Restricted Use Soil Cleanup Objectives-Protection of Groundwater	B1-COMP-1/0-5'		B1-COMP-2/5-10'	
Sample Description				Composite of fill collected from boring B1		Composite of fill collected from boring B1	
Sample Depth				0-5'		5-10'	
Sampling Date				5/10/2023		5/10/2023	
Compound	CAS Number			Result	Q	Result	Q
Semi-Volatiles, 8270		mg/kg dry	mg/kg dry	mg/kg dry		mg/kg dry	
Benzo(a)anthracene	56-55-3	1	1	0.0527	J	0.0481	U
Benzo(a)pyrene	50-32-8	1	22	0.0599	J	0.0552	J
Benzo(b)fluoranthene	205-99-2	1	1.7	0.0456	J	0.0481	U
Benzo(k)fluoranthene	207-08-9	1	1.7	0.0447	U	0.0537	J
Chrysene	218-01-9	1	1	0.0577	J	0.0506	J
Fluoranthene	206-44-0	100	1,000	0.0542	J	0.0583	J
Pyrene	129-00-0	100	1,000	0.077	J	0.0821	J
Herbicides, 8151		mg/kg dry	mg/kg dry	mg/kg dry		mg/kg dry	
Dalapon	75-99-0	~	~	0.0748		0.0227	U
Non-Halogenated Organics (8015D)		mg/kg dry	mg/kg dry	mg/kg dry		mg/kg dry	
Diesel Range Organics		~	~	38.5		21.3	
Metals, 6010		mg/kg dry	mg/kg dry	mg/kg dry		mg/kg dry	
Aluminum	7429-90-5	~	~	9,670		8,600	
Antimony	7440-36-0	~	~	3.85	M	2.71	M
Arsenic	7440-38-2	16	16	8.14		5.49	
Barium	7440-39-3	350	820	53.5		97	
Beryllium	7440-41-7	14	47	0.466		0.41	
Calcium	7440-70-2	~	~	3,870	B	9,770	B
Chromium	7440-47-3	**36	~	13.4		17.6	
Cobalt	7440-48-4	*30	~	8.16		5.89	
Metals, 6010		mg/kg dry	mg/kg dry	mg/kg dry		mg/kg dry	
Copper	7440-50-8	270	1,720	32.9		22.3	
Iron	7439-89-6	*2,000	~	16,900		11,800	
Lead	7439-92-1	400	450	17.5		15.4	
Magnesium	7439-95-4	~	~	3,710		3,160	
Manganese	7439-96-5	2,000	2,000	207		242	
Nickel	7440-02-0	140	130	13.5		12.2	
Potassium	7440-09-7	~	~	1,170	B	690	B
Sodium	7440-23-5	~	~	189		121	
Vanadium	7440-62-2	*100	~	32.6		23.8	
Zinc	7440-66-6	2,200	2,480	41.1		74.5	

Notes:
(1) Only compounds detected in at least one sample are reported.
(2) Concentrations exceeding regulatory guidelines/limits are highlighted according to exceeded criteria.
~ - indicates there is no 6 NYCRR Part 375-6.8(b) Soil Cleanup Objective.
* - where there is no Soil Cleanup Objective, Supplemental Soil Cleanup Objectives are taken from CP-51.
** - Soil Cleanup Objectives are for trivalent chromium.
Q is the Qualifier Column with definitions as follows:
B - Analyte is found in the associated analysis batch blank. For volatiles, methylene chloride and acetone are common lab contaminants.
J- Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U- Not detected
M - The recovery for this element in the Continuing Calibration Verification exceeded 110% of the expected value. Positive detections may be biased high.

TABLE 2: SUMMARY OF VOC ANALYSIS ON GRAB SOIL SAMPLES

Sample ID		NYSDEC Part 375 Restricted Use Soil Cleanup Objectives- Residential	NYSDEC Part 375 Restricted Use Soil Cleanup Objectives- Protection of Groundwater	B1-GRAB-1/0-2'		B1-GRAB-2/3-5'		B1-GRAB-3/5-7'		B1-GRAB-4/8-10'		Trip Blank	
Sample Description				Grab of fill collected from boring B-1		Grab of fill collected from boring B-1		Grab of fill collected from boring B-1		Grab of fill collected from boring B-1		VOC Trip Blank	
Sample Depth				0-2'		3-5'		5-7'		8-10'			
Sampling Date				5/10/2023		5/10/2023		5/10/2023		5/10/2023		5/10/2023	
Compound	CAS Number			Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Volatile Organics, 8260		mg/kg dry	mg/kg dry	mg/kg dry		mg/kg dry		mg/kg dry		mg/kg dry		mg/kg dry	
2-Butanone (MEK)	78-93-3	100	0.12	0.0026	U	0.0032	U	0.022		0.0039	J	0.0002	U
Acetone	67-64-1	100	0.05	0.016		0.029		0.1		0.035		0.0026	

Notes:
(1) Only compounds detected in at least one sample are reported.
(2) Concentrations exceeding regulatory guidelines/limits are highlighted according to exceeded criteria.
Q is the Qualifier Column with definitions as follows:
J - Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U - Not detected

TABLE 3: SUMMARY OF ASBESTOS AND HAZARDOUS WASTE ANALYSIS ON SOIL

Sample ID		EPA Hazardous Waste Limits	B1-COMP-1/0-5'		B1-COMP-1/5-10'	
Description			Composite of fill collected from boring B-1		Composite of fill collected from boring B-1	
Sample Depth			0-5'		5-10'	
Sampling Date			5/10/2023		5/10/2023	
Compound	CAS Number		Result	Q	Result	Q
VOCs, TCLP RCRA		mg/L	mg/L		mg/L	
VOCs			ND*		ND*	
SVOCS, TCLP RCRA		mg/L	mg/L		mg/L	
SVOCs			ND*		ND*	
Pesticides, TCLP RCRA		mg/L	mg/L		mg/L	
Pesticides			ND*		ND*	
Herbicides, TCLP RCRA		mg/L	mg/L		mg/L	
Herbicides			ND*		ND*	
Metals, TCLP RCRA		mg/L	mg/L		mg/L	
Barium	7440-39-3	100	0.625	U	0.685	
Lead	7439-92-1	5	1.41	M	1.45	M
Ignitability			^{O}C		^{O}C	
Ignitability		**	NI		NI	
Corrosivity			pH units		pH units	
pH		NA	7.55		8.58	
Reactivity-Cyanide			mg/kg		mg/kg	
Reactivity - Cyanide		***	0.25	U	0.25	U
Reactivity-Sulfide			mg/kg		mg/kg	
Reactivity - Sulfide		***	15	U	15	U
Asbestos		%	%		%	
Asbestos		>1	ND		NA	

Notes:
(1) Only compounds detected in at least one sample are reported.
* - Result is determined by 20x rule on the totals result.
** - according to 40 CFR 261.23, a waste is hazardous if it is not a liquid and is capable, under standard temperature and pressure, of causing fire through friction, absorption of moisture or spontaneous chemical changes.
*** - according to 40 CFR 261.23, a waste is hazardous if it is a cyanide- or sulfide-bearing waste which generates toxic gases or vapors at a quantity sufficient to present a health danger. Threshold levels in mg/kg no longer apply.
Q - Qualifier Column
ND/U - Not detected
NI - Non-ignitable
NA - Not analyzed
M - The recovery for this element in the Continuing Calibration Verification exceeded 110% of the expected value. Positive detections may be biased high.

TABLE 4: SOIL CLASSIFICATION

Excavation	Excavation Depth/ Estimated Excess Soil (CY)	Boring ID	Soil Type	Soil Depth (ft. bgs)	Fill Material Classification*
Screening Building	0-10 ft./75-166 CY	B-1	Fill	0-5	Non-hazardous Restricted-use Fill[a,b]
				5-10	Non-hazardous General Fill[b,c]

Notes:

* - Fill material types, as per 6 NYCRR Part 360.13.

[a] - Contains <40% inert, non-putrescible non-soil constituents.

[b] - Exceedances of residential soil cleanup objective for iron are likely due to background conditions and does not impact it's Preliminary Fill Material Classification.

[c]- Exceedances of protection of groundwater soil cleanup objective for acetone is attributed to lab contamination and does not impact it's Preliminary Fill Material Classification.

SECTION 02 41 00
SITE DEMOLITION

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish all labor, materials, and equipment in accordance with the requirements of applicable Sections of Divisions 01 and 02.

B. In addition, the Contractor shall demolish and remove all concrete and asphalt paving, curbs, sidewalk, and miscellaneous yard piping, utilities, and structures as required and shown on the Contract Drawings during the construction work.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 14 00 – Coordination with Owner's Operations

B. Section 01 42 00 – References

C. Section 01 73 00 – Demolition and Execution of Work

D. Section 31 10 00 – Clearing, Grubbing, and Site Preparation

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. References shall be in accordance with reference standards, codes, and specifications as set forth herein and in Section 31 10 00 – Clearing, Grubbing, and Site Preparation.

1.04 SUBMITTALS

A. In accordance with the procedures and requirements set forth in Section 01 33 00 – Submittal Procedures, the Contractor shall submit the following:

1. Copies of all photographs and other records from the joint existing conditions surveys.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 DEMOLITION

A. Existing concrete and asphalt paving, curbs, sidewalk and miscellaneous yard piping, utilities, and structures within the areas designated for new construction work shall be completely demolished and all debris removed from the site.

05-02-23

B. Excavation caused by demolition shall be backfilled with fill free from rubbish and debris. Select fill or structural fill shall be used where specifically required on Contract Drawings.

C. Work shall be performed in such manner as not to endanger the safety of the workmen or the public or cause damage to nearby structures.

D. Provide all barriers and precautionary measures in accordance with Owner's requirements and other authorities having jurisdiction.

E. Where parts of existing pavements or structures are to remain in service, demolish the portions to be removed, repair damage, and leave the pavement or structure in proper condition for the intended use. Remove asphalt or concrete pavement, concrete, and masonry to the lines designated by saw-cutting, drilling, chipping, or other suitable methods. Leave the resulting surfaces reasonably true and even, with sharp straight corners that will result in neat joints with new construction and be satisfactory for the purpose intended. Where existing reinforcement extends into new construction, remove the concrete so that the reinforcing is clean and undamaged. Cut off other reinforcing 1/2-inch below the surface and fill with epoxy resin binder flush with the surface.

F. Prior to the execution of the work, the Contractor, Owner and Engineer shall jointly survey the condition of the adjoining and/or nearby pavements and structures. Photographs and records shall be made of any prior settlement or cracking of structures, pavements, and the like, that may become the subject of possible damage claims. Contractor shall provide Owner a copy of all records of the joint survey of conditions before demolition activities may begin.

3.02 DISPOSAL OF MATERIAL

A. All debris resulting from the demolition and removal work shall be disposed of by the Contractor at a properly permitted facility as part of the work of this Contract. All regulations covering material handling and disposal shall be followed. Material designated by the Engineer to be salvaged shall be stored on the construction site as directed. All other material shall be disposed of off-site by the Contractor at his expense.

B. Burning of any debris resulting from the demolition will not be permitted at the site.

END OF SECTION

SECTION 02 82 33

REMOVAL AND DISPOSAL OF ASBESTOS CONTAINING MATERIALS

PART 1 – GENERAL

1.01 SUMMARY

A. This Section details the minimum acceptable requirements for construction and demolition activities affecting Asbestos-Containing Materials (ACM), and asbestos-containing wastes as identified in Tables 1 through 3 provided at the end of this Section.

B. All work under this Contract shall be performed using methods, tools, and equipment that have demonstrated effectiveness in preventing asbestos fibers from migrating outside of the regulated abatement work area when used in accordance with manufacturer's recommendations. Contract work shall be performed to minimize the creation of airborne dust; minimize the quantity of asbestos waste generated; protect the health and welfare of all site personnel and the public; and avoid adverse environmental impacts.

C. The Contractor shall perform the abatement and disposal of additional Asbestos-Containing Materials (ACM), Presumed Asbestos-Containing Materials (PACM), and asbestos wastes not shown on the Contract Drawings (i.e., unforeseen conditions). These abatement and disposal activities shall be performed in accordance with this Section and applicable federal, state, and local regulations. In order to classify a suspect Asbestos-Containing Material (ACM) or PACM as non-asbestos containing, a bulk sample of the material must be collected, and the bulk sample must be sent to an analytical laboratory meeting the requirements set forth in Article 1.04A.1 of this Section. New York State regulations specify that only NYSDOL-licensed Asbestos Inspectors or licensed Asbestos Investigators are permitted to collect these bulk samples. Analytical results for bulk samples that are collected by individuals not licensed by the State will not be recognized or accepted as valid.

D. The percentages of asbestos in Asbestos-Containing Materials (ACM) that were analyzed are included in Table 1 attached, and the quantity and condition of known ACM are included in Table 2, attached. The Contractor shall include in Lump Sum bid, as specified in Section 01 20 00 – Measurement and Payment., the cost for development and implementation of a written asbestos control program for abatement and demolition. All documentation required below must be submitted to the Owner after the bid opening and within the time limits to be set by the Owner. Failure to submit this information within the specified time period may result in a disqualification of the Contractor’s bid.

E. The Contractor shall conduct work in accordance with General Contract Conditions and Special Contract Conditions.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 35 45 – Hazardous Materials Control

B. Section 01 73 00 – Demolition and Execution of Work

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. The Contractor shall comply with all applicable regulations, standards, and guidelines of federal, state, and local environmental and occupational safety and health agencies regarding Asbestos-Containing Materials (ACM), Presumed Asbestos-Containing Materials (PACM), and asbestos wastes. These regulations, standards, and guidelines include, but are not limited to the following:

1. Department of Transportation (DOT):

    a. 49 CFR 171 – General Information, Regulations, and Definitions

    b. 49 CFR 173 – Shippers: General Requirements for Shipments and Packaging

    c. 49 CFR 178 – Specifications for Packagings

2. Environmental Protection Agency (EPA):

    a. 40 CFR 61 – National Emission Standards for Hazardous Air Pollutants (NESHAP)

    b. 40 CFR 268 – Land Disposal Restrictions

    c. 40 CFR 302 – Designation, Reportable Quantities, and Notification

    d. 40 CFR 763 – Asbestos Hazard Emergency Response Act (AHERA)

3. New York State Department of Environmental Conservation (NYSDEC):

    a. 6 NYCRR 360 – Solid Waste Management Facilities

    b. 6 NYCRR 364 – Waste Transporter Permits

    c. 6 NYCRR 376 – Land Disposal Restrictions

4. New York State Department of Labor (NYSDOL):

    a. 12 NYCRR 56 – Asbestos Rules and Regulations

5. Occupational Safety and Health Administration (OSHA):

    a. 29 CFR 1910 – Occupational Safety and Health Standards for General Industry

b. 29 CFR 1910.28 – Safety Requirements for Scaffolding

c. 29 CFR 1910.1001 – Asbestos Standard for General Industry

d. 29 CFR 1910.134 – Respiratory Protection Standard

e. 29 CFR 1910.1200 – Hazard Communication Standard

f. 29 CFR 1926 – Safety and Health Regulations for Construction

g. 29 CFR 1926.1101 – Asbestos Standard for the Construction Industry

6. Underwriters Laboratories, Inc. (UL):

7. UL 586 – Standard for Safety High Efficiency, Particulate, Air Filter Units.

1.04 SUBMITTALS

A. The Contractor shall submit items as required in Section 01 33 00 – Submittal Procedures, including, but not limited to those listed below for the approval of the Engineer:

1. Analytical Laboratory Qualifications for Analyzing Air and Bulk Samples: Submit the name, address, and telephone number of each analytical laboratory selected to perform the analyses of all air samples collected for area and exposure monitoring purposes, as well as all bulk samples collected to classify all potential suspect Asbestos-Containing Materials (ACM) and/or Presumed Asbestos-Containing Materials (PACM). The analytical laboratory shall be currently accredited by the American Industrial Hygiene Association (AIHA) and the NYSDOH's Environmental Laboratory Approval Program (ELAP). Provide copies of current AIHA and ELAP certificates along with date(s) of accreditation/reaccreditation. ELAP certificates should show evidence of certification for the analytical method(s) that will be used to analyze each sample.

2. Asbestos Inspection and Sampling Plan: The Contractor shall provide an Asbestos Inspection and Sampling Plan to investigate suspect materials as shown on Table 3 attached, and any unforeseen asbestos-containing materials, and collect confirmatory samples, as appropriate during the inspection. The Asbestos Inspection and Sampling Plan shall be submitted to and approved by the Engineer before any work under this Section can begin. The Asbestos Inspection and Sampling Plan shall include at a minimum:

a. Credentials of the individual responsible for inspection and sampling. At a minimum, the inspection shall be performed by a certified NYSDOL Asbestos Inspector, who shall have current OSHA 10-hour certification, and confined space entry training, as applicable to the location or work, and shall

have performed similar inspection work on at least three (3) projects of comparable scope.

b. Credentials of the laboratory providing sample analysis. The credentials shall include current certification by the NYSDOH ELAP.

c. Sample collection, analysis, and reporting protocol in accordance with 12 NYCRR Part 56.

d. Health and safety protocol (Job Hazard Analysis) for all investigation activities.

3. Asbestos Inspection Report: The Contractor shall provide an Asbestos Inspection Report summarizing the results of all inspection activities, and as applicable, a sampling narrative, laboratory data packages and inventory of all identified suspect and confirmed asbestos-containing materials. All reporting shall be in accordance with 12 NYCRR Part 56.

4. Asbestos Control Plan: The Contractor shall submit a detailed, project-specific plan of work procedures to be used during activities affecting Asbestos-Containing Materials (ACM), Presumed Asbestos-Containing Materials (PACM), and asbestos wastes. The plan shall be prepared in accordance with all pertinent federal, state, and local regulations. In addition, the plan shall be signed by a Certified Industrial Hygienist (CIH) meeting the qualifications set forth in Article 1.06K of this Section. The Asbestos Control Plan shall be submitted to and approved by the Engineer before any work under this Section can begin. The Asbestos Control Plan shall include the following:

a. Drawings showing the locations and details of the following:

1) ach regulated asbestos work area;

2) Negative air pressure equipment that will be used;

3) Proposed electrical hookups and temporary electrical panels;

4) Proposed water hookups;

5) Each restricted area;

6) Each personal decontamination enclosure system;

7) Each waste decontamination enclosure system;

8) Each waste storage area (e.g., dumpster, trailer, roll-off, etc.);

9) Restroom areas;

10) Areas designated for eating, drinking, and smoking;

b. A detailed discussion regarding the interfacing of trades (i.e., how the Contractor will coordinate asbestos abatement and disposal activities with other contractors or Owner's employees working at the site) and the sequencing of asbestos-related work;

c. A detailed discussion regarding the collection, filtering, and disposal of wastewater;

d. A detailed discussion regarding the collection, handling procedures, and disposal of asbestos wastes;

e. A detailed discussion regarding the methodologies that will be used to conduct exposure monitoring and area monitoring activities. Also, provide the name and qualifications (i.e., training and experience documentation) of the NYSDOL-licensed Asbestos Project Monitor or NYSDOL-licensed Asbestos Air Sampling Technician who will be responsible for conducting the air monitoring activities. The Asbestos Project Monitor (working only in the capacity of an Asbestos Air Sampling Technician) or Asbestos Air Sampling Technician shall at a minimum, satisfy the requirements set forth in Article 1.07G.4 of this Section;

f. A detailed discussion of housekeeping practices to be used for maintaining clean regulated abatement work areas, clean restricted areas, and clean decontamination enclosure systems;

g. A detailed discussion regarding the specific methods and procedures that will be used to control fiber releases, and ensure that fiber concentrations of 0.01 f/cc of air are not exceeded outside of each regulated abatement work area;

h. A detailed task analysis for each work activity that has the potential to disturb ACM, PACM, and/or asbestos wastes. Each task analysis shall include, but shall not be limited to, the following information:

1) The type of work activity;

2) The tools/equipment that will be used;

3) Operation and maintenance practices and procedures that will be used for the tools/equipment;

4) The type(s) of ACM, PACM, and asbestos wastes that may be disturbed when performing the activity;

5) The engineering controls that will be used to control the spread of asbestos fibers during the activity;

6) The proposed crew size for the activity and individual employee responsibilities during the activity;

7) Housekeeping procedures that will be used during the activity;

8) Protective work clothing, Personal Protective Equipment (PPE), and proposed respiratory protection that will be used for the activity;

i. A detailed schedule for the implementation of the Asbestos Control Plan elements. The schedule shall clearly indicate the starting and completion dates for each asbestos project, and shall allow adequate time for cleanup, inspections, and monitoring activities;

j. An administrative control schedule (if anticipated or necessary);

k. The name and qualifications (i.e., experience and training documentation) of the NYSDOL-licensed Asbestos Supervisor or NYSDOL-licensed Asbestos Project Monitor who will be responsible for the oversight and execution of the Asbestos Control Plan during activities affecting ACM, PACM, and asbestos wastes. At a minimum, this individual shall satisfy the requirements set forth in Article 1.07G.2 of this Section.

5. Rental equipment notification as defined in Article 2.01C of this Section.

6. Asbestos Waste Management Plan: The execution of the Asbestos Waste Management Plan must be coordinated with the Asbestos Waste Management Plan shall comply with all applicable federal, state, and local asbestos regulations, and address the following:

a. A description of the types of Asbestos-Containing Materials (ACM), Presumed Asbestos-Containing Materials (PACM), and asbestos wastes associated with the work (include details regarding whether the materials are friable or non-friable);

b. The estimated quantity of each waste stream that will be generated and disposed;

c. The names, addresses, phone numbers, and qualifications of each vendor and facility that will be transporting, storing, and/or disposing of the asbestos wastes. Include a 24-hour phone contact for each vendor and facility. In

addition, provide copies of current federal, state, and local asbestos waste permits, and verify if there are any outstanding violations or enforcement actions;

d. The name and qualifications (i.e., experience and training documentation) of the NYSDOL-licensed Asbestos Supervisor or NYSDOL-licensed Asbestos Project Monitor who will be responsible for the oversight and execution of the Asbestos Waste Management Plan. At a minimum, this individual shall satisfy the requirements set forth in Article 1.07G.2 of this Section;

e. A list of waste handling equipment to be used in performing the work, including but not limited to, cleaning, volume reduction, and transport equipment;

f. Spill prevention, containment, and cleanup contingency measures to be implemented during the work;

g. A detailed discussion of the on-site storage, handling, removal, and disposal of waste materials. This discussion shall include, but is not limited to the following:

1) Specifications for a secondary containment system;

2) The methods of demarcation that will be used to identify the waste storage area(s) and each waste container;

3) The methods and procedures that will be used to collect and containerize wastes on a daily basis;

4) The types of bags and containers that will be used to containerize the wastes;

5) The posting of weekly waste inspection records.

7. Chemical Analysis and Safety Data Sheets (SDS): Provide Chemical Analysis and Safety Data Sheets (SDS) for all chemical products to be used in the work. Show by copy of transmittal form, that a copy of each SDS has been transmitted to the NYSDOL-licensed Asbestos Supervisor or NYSDOL-licensed Asbestos Project Monitor who will be responsible for the execution and oversight of the Asbestos Control Plan and the Asbestos Waste Management Plan prior to the start of any work activities.

8. Equipment List: Identify the equipment that will be used to control, remove, collect, and containerize the Asbestos-Containing Materials (ACM), Presumed Asbestos-Containing Materials (PACM), and asbestos wastes generated during abatement, handling, transportation, housekeeping, disposal, and demolition activities.

9. Training and Experience: For all activities that will take place within a regulated abatement work area, the Contractor shall submit for this Contract a sufficient number of properly trained and experienced Asbestos Workers/Handlers, each of whom shall:

    a. Have completed an EPA/NYSDOH-approved Asbestos Worker/Handler or Asbestos Supervisor training course within the past year;

    b. Have a current Asbestos Worker/Handler or Asbestos Supervisor license issued by the NYSDOL;

    c. Meet the experience requirements set forth in Article 1.07G.2 and/or Article 1.07G.3 of this Section.

10. Medical Surveillance: For all activities that take place within a regulated abatement work area, the Contractor shall submit for this Contract a sufficient number of properly trained and experienced workers, each of whom shall:

    a. Have received a medical exam that included a Pulmonary Function Test (PFT) within the past year;

    b. Have received written medical clearance within the past year, by a licensed physician, to wear a respirator;

    c. Have received a qualitative or quantitative respirator fit test for the specific respirator the employee will be using for this work, within the past year.

11. Documentation: Documentation for each employee shall be provided to the Owner including:

    a. Copies of current NYSDOL Asbestos licenses for Asbestos Workers/Handlers, Supervisors, Project Monitors, and Air Sampling Technicians that will be used for each asbestos project;

    b. Copies of resumes for Asbestos Workers/Handlers, Supervisors, Project Monitors, and Air Sampling Technicians that will be used for each asbestos project, indicating work experience as defined in Article 1.07G of this Section;

    c. Dates and written proof of initial medical surveillance by the Contractor or other employer within the past year, and proof that the employee is currently participating in the employer's ongoing medical surveillance program in accordance with Paragraph 10 of this Article;

    d. Dates and written proof of respiratory clearance and a completed medical exam in accordance with paragraph 10 of this Article of this Section;

e. Dates and written proof of a respirator fit test in accordance with Paragraph 10 of this Article.

12. A signed and notarized statement disclosing all of the Contractor's OSHA, EPA, and NYSDOL citations on asbestos projects within the past three (3) years. If the Contractor will be using a subcontractor, a signed and notarized statement disclosing all of the subcontractor's OSHA, EPA, and NYSDOL citations on asbestos projects within the past three (3) years will also be required.

B. Field Reports, Records, and Health and Safety Programs: During all operations under this Contract, the Contractor shall maintain and provide the following documentation:

1. Air Sampling Documentation: All air monitoring results, and daily air monitoring reports shall be provided to the Owner within 24 hours of the date the samples are collected. The results shall be signed by the laboratory employee(s) that analyzed or supervised the analysis of the sample(s), as well as the NYSDOL-licensed Asbestos Air Sampling Technician or NYSDOL-licensed Asbestos Project Monitor that physically performed the air sampling at the work site. All laboratory analytical results shall be accompanied by complete chain-of-custody documentation.

a. Each daily air monitoring report shall be signed by the Contractor's Employee who generated the report. The content of these reports shall include, but is not limited to, the following information:

1) Sample "start" and "stop" times;

2) Flow rates (initial and final) for each sample;

3) The total volume of air collected for each sample;

4) Sample location descriptions/ sample location drawings/ names of individuals being sampled;

5) Types (i.e., makes and models) of sampling equipment used;

6) Types of sample media (i.e., filters and cassettes) used;

7) The most recent calibration dates, along with the calibration results, for the sampling equipment used;

8) Name of the NYSDOL-licensed Asbestos Air Sampling Technician or NYSDOL-licensed Asbestos Project Monitor that conducted the air sampling;

9) Date(s) that the sampling was conducted;

10) Work tasks being performed during the sampling;

11) Sample numbers used to identify each sample;

12) The phase of the asbestos project being performed (i.e., background, pre-abatement, abatement, cleaning, clearance, etc.)

2. Asbestos Waste Documentation: A Waste Profile for all asbestos waste shall be completed and submitted to the Engineer for review and approval prior to Owner's signature. The Contractor shall submit a Letter of Acceptance from the selected asbestos-permitted landfill stating that the facility will accept the asbestos wastes generated during abatement. The Contractor shall also submit advance copies of the completed manifest for the Engineer's review and approval, prior to Owner's signature on the date of disposal. Following disposal, completed, and signed asbestos waste manifests from an approved, asbestos-permitted landfill, shall be provided to the Owner within ten (10) days of disposal. In addition, on-site asbestos waste storage area(s) shall be inspected weekly by the NYSDOL-licensed Asbestos Supervisor or NYSDOL-licensed Asbestos Project Monitor, who at a minimum shall satisfy the requirements set forth in of Article 1.07G.2 of this Section.

a. Each weekly asbestos waste storage area inspection shall be documented in the form of a written report, and each report shall be signed by the Contractor's employee who generated the report. All reports shall be provided to the Owner within 24 hours of the date the inspection is completed. The content of these reports shall include, but is not limited to, the following information:

1) The name of the individual that conducted the inspection;

2) Descriptions of waste streams being stored;

3) Types and quantities of waste containers being used;

4) The current disposal status (i.e., when the waste container is scheduled to be removed from the work site) and physical condition of each waste container;

5) The condition of each waste storage area;

6) The presence/absence of proper labeling for each waste container in accordance with Article 3.01D of this Section and federal, state, and local regulations.

3. Asbestos Project Inspection Documentation: Regulated abatement work areas and restricted areas shall be inspected daily by the NYSDOL-licensed Asbestos

Supervisor or NYSDOL-licensed Asbestos Project Monitor, who at a minimum shall satisfy the requirements set forth in Article 1.07G.2 of this Section.

a. Each daily asbestos project inspection shall be documented in the form of a written report, and each report shall be signed by the Contractor's employee who generated the report. All reports shall be provided to the Owner within 24 hours of the date the inspection is completed. The content of these reports shall include, but is not limited to, the following information:

1) Type of asbestos project (i.e., large, small, or minor);

2) Phase of project (i.e., mobilization, background pre-abatement, abatement, cleaning, clearance air monitoring, containment breakdown, etc.);

3) Names of licensed Asbestos Workers/Handlers, Supervisors, Project Monitors, and Air Sampling Technicians on site, as well as the name of the company each individual is representing;

4) Types of air monitoring being conducted, and the number of samples being collected;

5) Any non-compliance issues observed (i.e., observations that conflict with the requirements of the Contractor's Asbestos Control Plan, the Contractor's Asbestos Waste Management Plan, this Section, and/or federal, state, and local regulations) along with the corrective actions that were taken to achieve compliance.

4. Contractor Project Record: The Contractor shall maintain a project record at the work site. The project record shall be maintained by the NYSDOL-licensed Asbestos Supervisor or NYSDOL-licensed Asbestos Project Monitor who at a minimum shall satisfy the requirements set forth in Article 1.07G.2 of this Section. The Contractor Project Record shall be made available to the Engineer or Owner for review at any time during the asbestos project and shall be submitted to the Owner within 24 hours after the completion of the asbestos project.

a. At a minimum, the Contractor Project Record shall contain the following information:

1) Copies of NYSDOL asbestos licenses for all individuals working on the asbestos project;

2) Copies of all notifications, amendments and variances related to the asbestos project;

3) Copies of all air sampling results generated during the asbestos project;

4) Documentation of all pressure differential readings for regulated abatement work areas, as defined in Article 1.07F of this Section;

5) Copies of all available bulk sample analytical data as well as asbestos inspection reports relating to the asbestos project;

6) Copies of all daily sign-in sheets, as defined in Paragraph 5 of this Article;

7) A list of emergency phone numbers, including the local fire department, local police department, nearest hospital, as well as phone numbers for the Engineer and Owner personnel responsible for administering the asbestos abatement

8) A copy of the NESHAP regulations for asbestos (40 CFR 61, Subpart M);

9) Copies of all Safety Data Sheets (SDS) pertaining to all chemicals being used during the asbestos project;

10) A copy of this Section;

11) A copy of the Contractor's Asbestos Control Plan;

12) A copy of the Contractor's Asbestos Waste Management Plan.

5. Daily Sign-In Sheets: The Contractor shall generate daily sign-in sheets for all individuals entering and exiting each regulated abatement work area and restricted area, for the duration of the asbestos project. The daily sign-in sheets shall be maintained by the NYSDOL-licensed Asbestos Supervisor or NYSDOL-licensed Asbestos Project Monitor who satisfies the requirements set forth in Article 1.07G.2 of this Section. Daily sign-in sheets shall be made available to the Engineer or Owner for review at any time during the asbestos project, and all daily sign-in sheets shall be submitted to the Owner within 24 hours after the completion of the asbestos project. At a minimum, each daily sign-in sheet shall include:

   a. The individual's full name (printed);

   b. The individual's signature;

   c. The name of the company the individual is representing;

   d. The time of entry and exit from the area(s);

e. Verification by the NYSDOL-licensed Asbestos Supervisor or NYSDOL-licensed Asbestos Project Monitor that the individual possesses current NYSDOL asbestos licenses, if the individual intends to enter a regulated abatement work area.

6. Hazard Communication Program: The Contractor shall establish and implement a Hazard Communication Program as required by 29 CFR 1910.1200. The Contractor's Hazard Communication Program shall be made available to the Engineer or Owner for review at any time during the Work.

1.05 PAYMENT

A. All costs associated with the removal and disposal of suspect/confirmed ACM and resulting wastes as shown on Table 3 attached, and unforeseen asbestos and resulting wastes that are not identified in Tables 1 through Table 3 shall be reimbursed under a Hazardous Materials Allowance, as specified in Section 01 20 00 – Measurement and Payment.

B. Except for the allowance specified herein, no separate payment will be made for performing any other Work required under this Section and the Contractor shall include all costs thereof in the Lump Sum bid, as specified in Section 01 20 00 – Measurement and Payment.

C. The following information shall be included with the invoice for each payment request:

1. Type of work completed;

2. Copy of the "Notice to Proceed" order;

3. Certification of work completion and the date of completion;

4. Quantities of Asbestos-Containing Materials (ACM), Presumed Asbestos-Containing Materials (PACM), and/or asbestos wastes involved in the work;

5. Copy of completed asbestos waste manifest(s);

6. Total amount of Contract;

7. Itemized breakdown of the costs associated with the work;

8. Number of overtime hours worked (if applicable);

9. Copies of applicable EPA and NYSDOL permit application(s)/notification(s);

10. Copies of applicable EPA and NYSDOL fee payment(s);

11. Copies of all variance application(s) and fee(s) (if applicable).

D. The Owner will inspect the work performed, review the costs, and approve or reject requests for payment as provided by the General Conditions.

1.06 DEFINITIONS

A. Abatement: Any and all procedures physically taken to control fiber releases from Asbestos-Containing Materials (ACM) and Presumed Asbestos-Containing Materials (PACM). This includes the removal, encapsulation, enclosure, repair, and/or handling of these materials. This also includes the handling and disposal of items which are attached to ACM or PACM (e.g., a pipe segment consisting of an asbestos-containing gasket secured between two pipe flanges) during demolition activities.

B. Adequately Wet: Defined by the EPA (40 CFR 61.141) as a material sufficiently mixed or penetrated with amended water to prevent the release of visible emissions. If visible emissions are observed coming from an Asbestos-Containing Material (ACM), Presumed Asbestos-Containing Material (PACM), or asbestos waste, then the material has not been “adequately wetted.”

C. Aggressive Air Sampling: A method of sampling in which mechanical equipment is used before and during the sampling period to stir up settled dust/asbestos fibers. Mechanical equipment includes the use of 20-inch fans and forced air equipment (e.g., a 1-horsepower leaf blower).

D. Airlock: A system for permitting entrance and exit, while restricting air movement between a contaminated area and an uncontaminated area.

E. Amended Water: Water to which a surfactant/wetting agent has been added in order to increase the liquid’s ability to adhere to dust/fibers and prevent the dust/fibers from becoming airborne.

F. Area Monitoring: Stationary air sampling inside and outside the regulated abatement work area and restricted area for the purpose of complying with Asbestos Control Program Rules and Regulations. Area monitoring shall be conducted during the background air monitoring, pre-abatement, abatement, cleaning/re-cleaning, and final clearance phases of large and small asbestos projects. For the purpose of this Section, area monitoring shall also be conducted during these phases of minor asbestos projects. All area monitoring shall follow a pertinent NIOSH or EPA sampling methodology (e.g., NIOSH 7400, EPA AHERA, etc.).

G. Asbestos: Any naturally occurring, hydrated, mineral silicate separable into commercially usable fibers, including chrysotile (serpentine), amosite (cumingtonite-grunerite), crocidolite (riebeckite), tremolite, anthophyllite, and actinolite.

H. Asbestos-Containing Material (ACM): Any material containing greater than one percent (1%) asbestos.

I. Asbestos Project: Any form of work performed in connection with the alteration, renovation, modification, or demolition of a building or structure which will involve the abatement or disturbance of friable and/or non-friable asbestos. Asbestos projects are classified as either large projects, small projects, or minor projects in New York State, and each type of project involves several phases, which can include background air monitoring, mobilization, pre-abatement/containment construction, abatement, cleaning/re-cleaning, final clearance air monitoring, containment breakdown, and demobilization.

J. Asbestos Waste: Non-specific waste including Asbestos-Containing Materials (ACM), Presumed Asbestos-Containing Materials (PACM), water, dust, and/or debris generated during the abatement, disturbance, handling, and/or cleanup of ACM or PACM. This also includes objects contaminated by ACM or PACM, or items attached to ACM or PACM that are subject to demolition and disposal.

K. Certified Industrial Hygienist (CIH): Refers to an Industrial Hygienist employed by the Contractor who is currently certified by the American Board of Industrial Hygiene (AHIA) in comprehensive practice.

L. Clean Room: An uncontaminated area or room, which is part of the personal decontamination enclosure system, with provisions for the storage and changing of street clothes into clean protective work clothing and clean Personal Protective Equipment (PPE).

M. Cleanup Activities: The utilization of HEPA-vacuuming equipment, wet cleaning methods, or both, to control and eliminate accumulations of Asbestos-Containing Materials (ACM), Presumed Asbestos-Containing Materials (PACM), and/or asbestos wastes.

N. Clearance Air Monitoring: Area air monitoring performed inside the regulated abatement work area after the completion of the final cleaning and final waiting period during an asbestos project. Aggressive air sampling shall be performed as part of the clearance air monitoring activities.

O. Containment: The negative-pressurized enclosure within the restricted area, which establishes the regulated abatement work area, and surrounds the location where the asbestos abatement is actually taking place.

P. Critical Barrier: Barriers that seal off all openings to or within the defined regulated abatement work area, including but not limited to operable windows, skylights, doorways, ducts, grills, diffusers, and any other penetrations to surfaces adjacent to or within the regulated abatement work area.

Q. Curtained Doorway: An assembly of overlapping plastic sheets in a framed doorway used to separate the rooms/areas within the personal and waste decontamination

enclosure systems and designed to inhibit airflow if the negative air ventilation system shuts down.

R. Disturbance: Any activities that disrupt the matrix of Asbestos-Containing Materials (ACM), Presumed Asbestos-Containing Materials (PACM), or asbestos wastes. This includes activities that generate debris, visible emissions, or airborne asbestos fibers, including moving friable ACM, PACM, or asbestos wastes from one place to another.

S. Encapsulation: The coating or spraying of Asbestos-Containing Materials (ACM), Presumed Asbestos-Containing Materials (PACM), or the bare surface exposed after an abatement, with a pigmented (non-transparent) liquid sealant that creates a membrane over the surface of the material (bridging encapsulant) or penetrates into the material and binds its components together (penetrating encapsulant).

T. Enclosure: The construction of airtight walls, ceilings, and floors between the Asbestos-Containing Material (ACM), Presumed Asbestos-Containing Materials (PACM), or surfaces coated with these materials, and the building/structure environment, in order to prevent the release of asbestos fibers.

U. Equipment Room: A contaminated area or room, which is part of the personal decontamination enclosure system, with provisions for the storage of contaminated protective work clothing and contaminated Personal Protective Equipment (PPE).

V. Exclusion Zone: (See definition of “Regulated Asbestos Work Area”).

W. Excursion Limit: Defined in the OSHA Asbestos Standard for the Construction Industry (29 CFR 1926.1101) as employee exposure, without regard to the use of respirators, to an airborne concentration of asbestos fibers of 1.0 fiber per cubic centimeter of air (1.0 f/cc) averaged over a 30-minute sampling period. No employee of the Contractor shall at any time be exposed to concentrations of asbestos fibers above the Excursion Limit.

X. Exposure Monitoring: Personal air sampling performed outside the respirator within the breathing zone of individual employees, for the purpose of determining compliance with OSHA’s Asbestos Standard for the Construction Industry (29 CFR 1926.1101), including the selection of appropriate respiratory protection for individuals within a regulated asbestos work area. For the purpose of this Section, exposure monitoring samples shall be collected from individuals who are representative of each type of work task being conducted by the Contractor, and all exposure monitoring shall follow a pertinent NIOSH or EPA sampling methodology (e.g., NIOSH 7400, EPA AHERA, etc.).

Y. Friable Asbestos: Any Asbestos-Containing Material (ACM), Presumed Asbestos-Containing Material (PACM), or asbestos waste that can be crumbled, pulverized, or reduced to powder when dry, by hand or other mechanical pressure.

Z. Glovebag: A manufactured, impervious, bag-like enclosure with two inward-projecting long sleeve gloves, one inward-projecting waterwand sleeve, an internal tool pouch, and

an attached, labeled receptacle for asbestos waste. The glovebag is constructed and installed to surround an object or area to be abated, and contain all asbestos fibers released during the abatement process.

AA. High Efficiency Particulate Air (HEPA) Filter: A filter designed to remove 99.97% of all particles greater than 0.3 micrometers (µm) in diameter. For the purpose of this Section, HEPA vacuum and negative air pressure equipment (i.e., microtraps) used by the Contractor shall meet the Standard for Safety High-Efficiency, Particulate, Air Filter Units (UL 586) developed by Underwriters Laboratories.

BB. Holding Area: A room or area in the waste decontamination enclosure system utilized for the temporary storage of containerized asbestos waste, prior to its transfer to a final, on-site storage container (i.e., dumpster, trailer, roll-off, etc.) or a licensed asbestos waste transport vehicle. The holding area is located between the washroom and an uncontaminated area.

CC. Isolation Barrier: (See definition of “Critical Barrier”).

DD. Large Asbestos Project: An asbestos project involving the removal, enclosure, encapsulation, repair, disturbance, or handling of 260 linear feet or more of Asbestos-Containing Materials (ACM) and/or Presumed Asbestos-Containing Materials (PACM), or 160 square feet or more of ACM and/or PACM, or 35 cubic feet or more of ACM and/or PACM.

EE. Microtrap: (See definition of “Negative Air Pressure Equipment”).

FF. Minor Asbestos Project: An asbestos project involving the removal, enclosure, encapsulation, repair, disturbance, or handling of 25 linear feet or more of Asbestos-Containing Materials (ACM) and/or Presumed Asbestos-Containing Materials (PACM), or 10 square feet or more of ACM and/or PACM.

GG. Negative Air Pressure Equipment: A local exhaust system capable of maintaining air pressure within a containment at a lower pressure than the air outside of the containment. The negative air pressure equipment also provides for the HEPA filtration of all air exhausted from the containment.

HH. Non-Friable Asbestos: Any Asbestos-Containing Material (ACM), Presumed Asbestos-Containing Material (PACM), or asbestos waste that cannot be crumbled, pulverized, or reduced to powder when dry, by hand or other mechanical pressure.

II. Non-Friable Organically Bound (NOB) Asbestos: Non-friable Asbestos-Containing Materials (ACM) or Presumed Asbestos-Containing Materials (PACM) that are embedded in flexible-to-rigid asphalt or vinyl matricies, including but not limited to the following: flooring materials, adhesives, mastics, asphalt shingles, roofing materials, and caulks. The NYSDOH has determined that the analysis of bulk materials by Polarized Light Microscopy (PLM) is not enough to determine if a suspect material contains

asbestos. Therefore, per NYSDOH regulations, NOB materials must also be analyzed by Transmission Electron Microscopy (TEM) in order to prove that they do not contain asbestos.

JJ. OSHA Monitoring: (See definition of “Exposure Monitoring”).

KK. P-100 Filter: (See definition of: “High Efficiency Particulate Air (HEPA) Filter”).

LL. Perimeter Monitoring: (See definition of “Area Monitoring”).

MM. Permissible Exposure Limit (PEL): Defined in the OSHA Asbestos Standard for the Construction Industry (29 CFR 1926.1101) as employee exposure, without regard to the use of respirators, to an airborne concentration of asbestos fibers of 0.1 fiber per cubic centimeter of air (0.1 f/cc) calculated as an 8-hour Time-Weighted Average (TWA). No employee of the Contractor shall at any time be exposed to concentrations of asbestos fibers above the PEL.

NN. Personal Decontamination Enclosure System: A series of connected rooms designed to control the passage of asbestos workers/handlers, and other authorized individuals into the regulated abatement work area from uncontaminated areas. The system consists of a clean room, a shower room, and an equipment room separated from each other and the regulated abatement work area by airlocks and curtained doorways.

OO. Personal Monitoring: (See definition of “Exposure Monitoring”).

PP. Phase Contrast Microscopy (PCM): An analytical method (e.g., NIOSH 7400) used for determining the asbestos fiber concentration in an air sample.

QQ. Polarized Light Microscopy (PLM): An analytical method (e.g., 40 CFR 763, Subpart F, Appendix A) used for determining the asbestos content in a bulk material.

RR. Post Abatement Air Monitoring: (See definition of “Clearance Air Monitoring”).

SS. Presumed Asbestos-Containing Material (PACM): All potential friable and non-friable Asbestos-Containing Materials (ACM), as determined by a licensed NYSDOL Asbestos Inspector that has not been sampled and analyzed for asbestos content.

TT. Regulated Abatement Work Area: The portion of the restricted area where abatement work actually occurs. This includes the interior of the restricted area containment enclosure. For glovebag operations, the areas contiguous to where the operation takes place are regulated abatement work areas. For tents, the interior of each tent is a regulated abatement work area. For exterior, non-friable asbestos abatement conducted without the establishment of negative air ventilation systems or containment enclosures, the entire restricted area surrounding the abatement location is considered to be the regulated abatement work area.

UU. Remote Decontamination Enclosure System: Decontamination enclosure systems that are not attached to the regulated abatement work area but are within the restricted area.

VV. Removal: The stripping of any Asbestos-Containing Materials (ACM) or Presumed Asbestos-Containing Materials (PACM) from surfaces or components of a building or structure.

WW. Repair: A corrective action using specified work practices (e.g., glovebags, tents, etc.) to minimize potential asbestos fiber releases from damaged Asbestos-Containing Materials (ACM) or Presumed Asbestos-Containing Materials (PACM).

XX. Restricted Area: An area established and marked for the abatement portion of an asbestos project. The area shall include, but not be limited to, regulated abatement work areas and any contiguous decontamination enclosure systems, adjoining staging areas where work materials, debris, and/or waste materials from such work may accumulate, and waste storage areas (e.g., dumpsters, trailers, roll-offs, etc.).

YY. Shower Room: A room between the clean room and the equipment room in the personal decontamination enclosure system set up to prevent cross-contamination by ensuring the removal of potential asbestos contamination from the body that may have accumulated during abatement operations. The shower room shall have hot and cold running water controllable at the tap, clean towels, soap, and shampoo.

ZZ. Small Asbestos Project: An asbestos project involving the removal, enclosure, encapsulation, repair, disturbance, or handling of more than 25 linear feet but less than 260 linear feet of Asbestos-Containing Materials (ACM) and/or Presumed Asbestos-Containing Materials (PACM), or more than 10 square feet but less than 160 square feet of ACM and/or PACM, or less than 35 cubic feet of ACM and/or PACM.

AAA. Suspect Asbestos-Containing Material (ACM): (See definition of “Presumed Asbestos-Containing Material (PACM)”).

BBB. Time-Weighted Average (TWA): The average time over a given work period (e.g., an 8-hour workday) of a person’s exposure to a chemical or agent. The average is determined by sampling for the chemical or agent throughout the time period.

CCC. Transmission Electron Microscopy (TEM): An analytical method (e.g., 40 CFR 763, Subpart F, Appendix A) used for determining the asbestos fiber concentration in an air sample or for determining the asbestos content in a bulk material.

DDD. Variance: Relief from specific requirements set forth in state and/or local asbestos regulations, which is granted in writing by the agency that enforces the regulations. Variances can be “site-specific (SSV)” or “applicable (AV).”

EEE. Visible Emission: Any emission containing particulate material that can be seen without the aid of instruments.

FFF. Washroom: An area or room between the regulated abatement work area and the holding area in the waste decontamination enclosure system, where contaminated equipment and waste containers are wet cleaned and/or HEPA vacuumed prior to disposal and/or passage into an uncontaminated area.

GGG. Waste Decontamination Enclosure System: A series of connected rooms designed to control the transfer of materials and equipment from the regulated abatement work area. The system consists of a washroom and a holding area separated from each other and the regulated abatement work area by airlocks and curtained doorways.

HHH. Waste Staging Area: The area near the airlock to the waste decontamination enclosure system where bagged or containerized asbestos waste has been placed prior to removal from the regulated abatement work area.

III. Wet Cleaning: The process of eliminating asbestos contamination from surfaces, equipment, or other objects by using cloths, mops, or other cleaning tools that have been saturated with amended water.

JJJ. Worker Decontamination Enclosure System: (See definition of “Personal Decontamination Enclosure System”).

1.07 QUALITY ASSURANCE

A. Permits and Notifications: The Contractor shall make all necessary notifications, secure any necessary permits and variances, and pay all fees in conjunction with asbestos abatement, waste transportation, and waste disposal in accordance with federal, state, and local asbestos regulations. Prior to the submittal of any notifications to regulatory agencies, the Contractor shall provide them to the Engineer for review.

B. Scheduling: The Contractor shall coordinate and schedule all phases of the work of the Contract with the Owner, subcontractors, material suppliers, and other parties as necessary to ensure the proper execution of the work.

C. Compliance: In addition to the detailed requirements of this Section, the Contractor shall comply with all applicable regulations of federal, state, and local authorities pertaining to the abatement, disturbance, transportation, storage, and disposal of Asbestos-Containing Materials (ACM), Presumed Asbestos-Containing Materials (PACM), and asbestos wastes. All matters regarding the interpretation of any regulations or standards shall be submitted to the Engineer for resolution before starting the work. Where the requirements of this Section and federal, state, or local regulations conflict or vary, the most stringent requirements or regulations shall apply.

D. Rejection of Non-Complying Items: The Owner reserves the right to reject items incorporated into the work which fail to meet the specified minimum requirements. The Owner also reserves the right to reject Contractor submittal items that it deems inappropriate or unacceptable. Included in the category of non-complying items are

proposed vendors, subcontractors, or personnel with regulatory citations/violations. The Owner further reserves the right, and without prejudice to other recourse, to accept non-complying items subject to an adjustment in the Contract amount, as approved by the Owner.

E. Air Sampling: If at any time, PCM analysis of any air sample in any phase of the asbestos project (i.e., background, pre-abatement, abatement, cleanup, or clearance) indicates that the filter was “overloaded” and a fiber count cannot be obtained, the sample shall immediately undergo TEM analysis. All costs of the additional TEM analysis will be at the Contractor’s expense.

F. Containments and Negative Air Pressure Equipment: Pressure differential readings for each workday shall be obtained by the NYSDOL-licensed Asbestos Supervisor or NYSDOL-licensed Asbestos Project Monitor and shall be reviewed by the CIH daily. All readings shall be documented and kept in the Contractor’s Project Record, as defined in Article 1.04B.4 of this Section. The CIH shall notify the Contractor and the Owner immediately if any variations in the pressure differential readings could lead to the migration of asbestos fibers outside of a regulated abatement work area.

G. Qualifications:

1. Contractor: The Contractor shall have successfully completed at least two (2) asbestos projects of comparable scope and methodologies to this Contract within the past three (3) years. This experience shall be documented by identifying the following:

    a. The name, address, and phone number of each facility where the work was performed;

    b. The name of the individual representing the owner who supervised the work at each facility;

    c. The type(s) of facility where the work was performed;

    d. The volume and type of each material that was abated;

    e. The specific method(s) of abatement used at each facility (including the tools, technologies, and engineering controls employed);

    f. The name of each Asbestos Supervisor or Asbestos Project Monitor supervising the work on each project.

2. Asbestos Supervisor (or Asbestos Project Monitor): The Contractor shall have on staff and assigned to this Contract an Asbestos Supervisor or Asbestos Project Monitor, who shall have the following qualifications:

a. Shall be currently licensed by the NYSDOL;

b. Shall have a minimum of two (2) years' experience on asbestos projects;

c. Shall have a minimum of five (5) years' experience in construction trades;

d. Shall have served as the Asbestos Supervisor or Asbestos Project Monitor on at least three (3) asbestos projects of comparable scope and methodologies to the Work being performed under this Section.

3. Asbestos Worker/Handler: The Contractor shall have on staff and assigned to this Contract a sufficient number of experienced and properly trained Asbestos Workers/Handlers, who shall have the following qualifications:

a. Shall be currently licensed by the NYSDOL;

b. Shall have a minimum of one (1) year of experience on asbestos projects;

c. Shall have worked on at least three (3) asbestos projects of comparable scope and methodologies to the Work being performed under this Section.

4. Asbestos Air Sampling Technician (or Asbestos Project Monitor working only in the capacity of an Asbestos Air Sampling Technician): The Contractor shall have an Asbestos Air Sampling Technician or Asbestos Project Monitor assigned to this Contract who is independent from the Contractor and shall have the following qualifications:

a. Shall be currently licensed by the NYSDOL;

b. Shall have a minimum of two (2) years' experience in conducting area and exposure air monitoring on asbestos projects in New York State.

1.08 SPECIAL REQUIREMENTS

A. Commencement of Work: Ten (10) days prior to the proposed start of work at each separate location, the Contractor shall notify the Engineer and the onsite safety staff. No work may proceed at any location until authorized by the Engineer.

B. The Contractor shall coordinate any required equipment shutdowns with the Engineer prior to starting the work.

C. Access Restrictions: The Contractor shall inform the Engineer of proposed access restrictions (i.e., areas or items of equipment which will not be accessible during the proposed asbestos project) and give them estimated time frames (including specific dates) of such proposed access restrictions. The Contractor shall be aware that other contractors may be at any of the work sites associated with this Contract. As a result, the

Contractor shall not have exclusive rights to any work site and shall fully cooperate and coordinate this work with the work of other contractors who may be on site. Therefore, the Contractor shall notify other contractors in advance of the removal and disposal work included herein, to provide them with sufficient time for coordination of interrelated items that are included in their contracts and that must be performed before, after, or in conjunction with the work included in this Contract.

D. Meetings: The Contractor shall visit and investigate the site, review the Contract Drawings, review this Section, and become familiar with any conditions which may affect the work, as part of the pre-construction meeting and site inspection. The Contractor shall hold all meetings with appropriate parties as scheduled and as otherwise necessary to accomplish the work of the Contract in accordance with its specific requirements and standards. In addition to the pre-construction meeting and site inspection, other meetings may be required or may be requested by the Engineer, including briefings with Operations personnel. Written documentation (i.e., “minutes”) of all meetings shall be generated by the Contractor, and copies shall be provided to the Owner within three (3) days following each meeting.

PART 2 – PRODUCTS

2.01 EQUIPMENT

A. Respirators: The Contractor shall select respirators approved by the National Institute for Occupational Safety and Health (NIOSH) for use in regulated abatement work areas where the abatement and/or disturbance of Asbestos-Containing Materials (ACM), Presumed Asbestos-Containing Materials (PACM), and/or asbestos wastes will occur. At a minimum, the Contractor shall provide each individual within a regulated abatement work area with a half-face or full-face Powered Air Purifying Respirator (PAPR) equipped with HEPA/P-100 filter cartridges, until exposure monitoring results indicate that respiratory protection can be modified. The CIH shall make all determinations regarding respiratory protection modifications that will be used for each asbestos project. All modifications shall be in accordance with the OSHA Asbestos Standard for the Construction Industry (29 CFR 1926.1101) and the Asbestos Control Plan.

B. Protective Work Clothing and Personal Protective Equipment (PPE): Each individual within a regulated abatement work area shall wear steel-toe, safety boots. The Contractor shall provide individuals within a regulated abatement work area with appropriate, disposable protective whole-body clothing, head coverings, plastic or rubber gloves, and foot coverings. Tape (e.g., duct tape) should be used to secure sleeves at the wrists and pants at the ankles, in order to prevent potential contamination from penetrating openings in the clothing. In addition, the Contractor shall provide each individual within a regulated abatement work area with a hard hat as well as appropriate eye protection and hearing protection.

C. Rental Equipment Notification: If rental equipment is to be used during the abatement, disturbance, handling, storage, transportation, and/or disposal of Asbestos-Containing Materials (ACM), Presumed Asbestos-Containing Materials (PACM), and/or asbestos wastes, the Contractor shall notify the rental agency in writing concerning the intended use of the equipment. All rental equipment data demonstrating compliance with the Contractor's Asbestos Control Plan and the Contractor's Asbestos Waste Management Plan must be presented to and approved by the Engineer prior to use.

D. HEPA Filters: HEPA/P-100 filters used in vacuuming equipment and negative air pressure equipment (i.e., microtraps) must meet or exceed any manufacturer's specifications and recommendations, as well as specifications presented in the Standard for Safety High Efficiency, Particulate, Air Filter Units (UL 586).

E. Containment Materials: Plastic sheeting used in the construction of temporary enclosures shall be fire retardant in accordance with NFPA Standard 701. Wood or other materials used in the construction of temporary enclosures shall be non-combustible or fire-retardant in accordance with NFPA 255, ASTM D-2898, ASTM E84, and UL 723.

PART 3 – EXECUTION

3.01 PROCESS AND PROCEDURES

A. Protection of Existing Work to Remain: All work involving the abatement and/or disturbance of Asbestos-Containing Materials (ACM), Presumed Asbestos-Containing Materials (PACM), and/or asbestos wastes, must be conducted without damage to, or contamination of equipment or surfaces within the regulated abatement work area(s), restricted area(s), or other areas adjacent to these area(s). All such damage or contamination shall be immediately corrected and cleaned up by the Contractor at the Contractor's expense.

B. Personal Decontamination Enclosure System: The Contractor shall ensure that employees do not leave a regulated abatement work area wearing any potentially contaminated protective work clothing or Personal Protective Equipment (PPE). Employees are required to shower prior to leaving the regulated abatement work area.

C. Signs: The Contractor shall post conspicuous warning signs at all approaches to regulated abatement work areas and restricted areas. The signs shall be located at such

DANGER

ASBESTOS CANCER AND LUNG DISEASE HAZARD

AUTHORIZED PERSONNEL ONLY

RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

a distance so that personnel may read the sign and take necessary precautions before entering a regulated abatement work area or restricted area. Signs shall comply with the requirements of federal, state, and local regulations. Once clearance air monitoring results indicate that a regulated abatement work area is in compliance with the provisions for re-occupancy set forth in 12 NYCRR 56, The signs shall be removed. At a minimum, each sign shall bear the following information in English and the predominant language that is spoken by the Contractor's employees if English is not spoken:

D. Labeling: The Contractor shall affix warning labels to all asbestos waste disposal bags and containers (i.e., drums, dumpsters, trailers, roll-offs, etc.). Labels shall comply with the requirements of federal, state, and local regulations, including the EPA, NYSDOT, and the Owner. At a minimum, each label on disposal bags shall bear the following information in English:

1. In addition to the information that is required for each disposal bag, each warning label on disposal containers shall also bear the following information in English:

[Generator Name, Address, and Telephone Number]

[Specific Contents of Container]

[Accumulation Start Date]

[Accumulation End Date]

CONTAINS ASBESTOS FIBERS

AVOID CREATING DUST

CANCER AND LUNG DISEASE HAZARD

E. Scaffolding: The Contractor shall furnish all the scaffolding of whatever type is necessary to do the work of this Contract, subject to requirements of the OSHA Safety Requirements for Scaffolding (29 CFR 1910.28), and the approval of the Owner. Scaffolding shall be inspected after its construction but prior to use by a Contractor employee, who is an individual qualified as a Competent Person to inspect scaffoldings, as defined by OSHA.

F. Utilities: The temporary use of any on-site utilities shall be subject to the approval of the Owner. The Contractor shall furnish all water needed for the asbestos project, as well as any temporary hookups and hoses necessary to supply water to a regulated abatement work area or a restricted area. Also, the Contractor shall supply any necessary heating equipment and water filtration devices necessary for the work. In addition, all temporary lighting and temporary electrical service to a regulated abatement work area or a

restricted area shall be provided by the Contractor and shall be in weather-proof enclosures and be ground fault protected.

G. Fire Extinguishers: The Contractor shall maintain at least two functional fire extinguishers in each Restricted Area. The fire extinguishers shall have a minimum rating of 2-A:10-B:C, and each fire extinguisher shall be checked daily by the Asbestos Handler Supervisor to ensure that it remains functional throughout the duration of the Asbestos Project.

H. Air Monitoring: Air monitoring for airborne concentrations of asbestos fibers shall be conducted by the NYSDOL-licensed Asbestos Air Sampling Technician or NYSDOL-licensed Asbestos Project Monitor in accordance with OSHA, and Articles 1.06F and 1.06X of this Section.

1. Exposure Monitoring: The Contractor shall collect personal air samples from employees who are anticipated to have the greatest risk of exposure, as determined by the CIH, NYSDOL-licensed Asbestos Supervisor, or NYSDOL-licensed Asbestos Project Monitor. Personal air samples shall be collected during each phase of the asbestos project (i.e., background, pre-abatement, abatement, and cleanup) for one work shift from at least one (1) employee that is representative of each type of work task that is being performed. Each personal air sample will “run” for the employee’s entire work shift in order to ensure that enough volume (of air) is collected, and an accurate 8-hour TWA can be calculated. Documentation regarding the sample numbers, specific shift when the sampling was conducted, the work task(s) that were sampled, the date(s) of sampling, the employee hours that were worked during the shift, and the total sampling time(s), shall accompany each laboratory chain-of-custody form.

2. Area Monitoring: The Contractor shall collect area air samples in accordance with the requirements of the Owner. During sampling activities, all air sample filter cassettes shall be positioned approximately five to six feet above the ground (in order to simulate an individual’s breathing zone) and shall not be placed immediately adjacent to obstructions (e.g., walls or columns) which may restrict the flow of air to the filter cassette. All clearance air monitoring results shall meet or be below background ambient air levels or 0.01 f/cc of air, prior to the breakdown of the containment. If clearance air monitoring results indicate a fiber count greater than background ambient air levels or 0.01 f/cc of air in any area, the Contractor will be required to re-clean that area. Repeated cycles of cleaning and clearance air monitoring will be performed until a fiber count is achieved that meets or is below background ambient air levels or 0.01 f/cc of air within the area. All costs of re-cleaning and additional clearance air monitoring will be at the Contractor's expense. Documentation regarding the sample numbers, sample locations, specific phase of the asbestos project when the sampling was conducted (i.e., background, pre-abatement, abatement, cleanup, or clearance),

the date of sampling, the employee hours that were worked during the shift, and the total sampling times, shall accompany each laboratory chain-of –custody form.

3. Documentation: Complete documentation of all air monitoring activities shall be in accordance with Article 1.04B.1 of this Section.

4. The Contractor shall submit all air monitoring results to the Owner within 24 hours from when the air samples were collected.

3.02 CLEANUP AND DISPOSAL

A. Cleanup: All cleaning work shall progress from the point most remote from the intakes of the negative air pressure system, towards the intakes of the system, as well as from the highest point of the surfaces to be cleaned towards the lowest point of the surfaces. The Contractor shall maintain all surfaces, including protective tarps, poly sheeting, and coverings within each regulated abatement work area and each restricted area, free of accumulations of dusts, wastes, and debris. The Contractor shall perform housekeeping activities daily throughout each work shift and at the end of each work shift, in order to prevent any accumulation of dusts, wastes, and debris in these areas. Dry sweeping and using compressed air to cleanup a regulated abatement work area or a restricted area shall be strictly prohibited. Instead, HEPA-filtered vacuums and wet cleaning methods shall be used to ensure that these areas remain free of visible dust and debris. In addition, only cleaning materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the materials, or as approved by the Owner, shall be used.

B. Clearance Air Monitoring: The Contractor shall not conduct clearance air monitoring until the regulated abatement work area has been inspected by the NYSDOL-licensed Asbestos Supervisor or NYSDOL-licensed Asbestos Project Monitor. It should be noted that according to New York State’s Asbestos Rules and Regulations (12 NYCRR 56), this inspection can only be performed by a NYSDOL-licensed Asbestos Project Monitor. During this inspection, the NYSDOL-licensed Asbestos Supervisor or NYSDOL-licensed Asbestos Project Monitor will determine if the following items have been achieved: (a) all Asbestos-Containing Materials (ACM), Presumed Asbestos-Containing Materials (PACM), and asbestos wastes have been abated and removed from the area; (b) abated components in the area have been encapsulated; (c) the area is dry; (d) critical barriers are intact; (e) negative air pressure equipment is turned on and functioning. If any of these items have not been achieved, the Contractor shall perform the necessary corrective actions to achieve compliance before conducting the clearance air monitoring.

C. Breakdown of the Regulated Abatement Work Area: Critical barriers shall not be removed, and negative air pressure equipment shall not be turned off until clearance air monitoring results meet the criteria specified in this Section.

D. Collection, Containerization, and Filtration of Wastes: The Contractor shall collect and containerize asbestos waste, debris, protective work clothing, Personal Protective Equipment (PPE), and containment materials on a daily basis in accordance with the Asbestos Waste Management Plan. Using chutes to move construction debris or waste (bagged or not bagged) will not be permitted at any time.

1. Prior to containerizing asbestos wastes, the waste shall be “adequately wet,” in accordance with Article 1.06B of this Section, and double-bagged in 6-mil polyethylene bags. The bags shall be “goose necked” and sealed air tight with duct tape, and each bag will be labeled in accordance with Article 3.01D of this Section before being placed in a container (i.e., dumpster, trailer, roll-off, etc.) for disposal.

2. Corrugated cartons or drums may be used in conjunction with polyethylene bags for the disposal of asbestos wastes that have sharp-edged components (e.g., nails, screws, tin sheeting, etc.) which may tear the bags. The waste within these drums or cartons must be double bagged in accordance with Paragraph 1 of this Article. In addition, the cartons/drums must be labeled in accordance with Article 3.01D of this Section.

3. Wastewater derived from the asbestos project shall be collected and filtered through a system with at least a 5.0-micron particle size collection capability. A system containing a series of several filters with progressively smaller pore sizes shall be used to avoid the rapid clogging of the filtration system by large particles. Filtered wastewater shall be discharged in accordance with all applicable federal, state, and local regulations. Discharging asbestos decontamination water to the Owner’s Facility will require written permission from the Owner and the submission of analytical testing results for asbestos to the client for review and approval prior to discharge. Contaminated filters shall be disposed of as asbestos waste.

4. The Contractor shall store all bagged asbestos wastes in DOT-approved container systems (e.g., roll-off, trailer, etc.). No container shall be filled in excess of the capacity marked on the container, and all containers shall be lined with 6-mil (0.006”) polyethylene sheeting, have a hard top, and shall be locking in addition to meeting any other federal, state, and local asbestos waste storage requirements. In addition, all containers shall have an intact and legible label affixed to it in accordance with Article 3.01D of this Section. No bagged asbestos waste shall be stored in a regulated abatement work area or decontamination enclosure system for longer than the current work shift which generated the waste.

5. Non-Asbestos Waste: The Contractor shall store non asbestos wastes separate from asbestos wastes, shall provide all non-asbestos waste containers, and shall make all transportation and disposal arrangements for non-asbestos wastes in accordance with federal, state, and local regulations.

E. Disposal of Wastes: The Contractor shall notify the Owner at least 7 days prior to the removal of any waste containers, so that the Owner can inspect the containers and review and approve the advance copies of the asbestos waste manifest(s). Asbestos wastes shall be disposed of to ensure that containers do not remain on the job site longer than necessary. Containers that have reached their storage capacity shall not remain on site and transportation arrangements shall be made for their immediate removal.

F. Disposal Documentation: The Contractor shall submit written evidence that the landfill receiving asbestos-containing waste is approved by federal, state, and local regulatory agencies to receive asbestos wastes. On the date of disposal, the Contractor shall submit one (1) copy of the completed manifest that has been signed and dated by the initial transporter in accordance with 40 CFR 262, to the Owner for signature as Generator. All manifests must be signed by the Owner or a designated alternative.

END OF SECTION

TABLE 1: SUMMARY OF ASBESTOS ANALYSIS

Sample ID	*HMG*	*Area*	*Sample Location*	*Material Description*	*Analytical Results (%)*		
					PLM	PLM-NOB	TEM
RCSD-ASB-01	1	Dumpster Room	CMU block wall	Grey mortar	ND	NA	NA
RCSD-ASB-02	2	Dumpster Room	Brick wall	Grey mortar	ND	NA	NA
RCSD-ASB-03	3	Dumpster Room	Around door frame	Grey caulk	NA	ND	ND
RCSD-ASB-04	3	Dumpster Room	Wall seam	Grey caulk	NA	ND	ND
RCSD-ASB-05	4	Dumpster Room	Around conduit penetration seams	Grey mortar	ND	NA	NA
RCSD-ASB-06	5	Dumpster Room	HVAC unit	Black vibration damper	NA	ND	ND
RCSD-ASB-07	5	Dumpster Room	HVAC unit	Black vibration damper	NA	ND	ND
RCSD-ASB-08	6	Dumpster Room	HVAC unit	White fiberglass insulation paper	ND	NA	NA
RCSD-ASB-09	7	Dumpster Room	Around door frame	Brown caulk	NA	ND	ND
RCSD-ASB-10	8	Dumpster Room	Conduit junction box	Black gasket	NA	ND	ND
RCSD-ASB-11	6	Screen Chamber	Piping	White fiberglass insulation paper	ND	NA	NA
RCSD-ASB-12	6	Screen Chamber	Piping	White fiberglass insulation paper	ND	NA	NA
RCSD-ASB-13	9	Screen Chamber	CMU wall	Grey putty	NA	ND	ND
RCSD-ASB-14	9	Screen Chamber	CMU wall	Grey putty	NA	ND	ND
RCSD-ASB-15	10	Screen Chamber	Around window frame	Grey caulk	NA	ND	ND
RCSD-ASB-16	11	Screen Chamber	Screen motor cover	Black gasket	NA	ND	ND
RCSD-ASB-17	10	Screen Chamber	Around door frame	Grey caulk	NA	ND	ND
RCSD-ASB-18	12	Exterior	Around window frame	Brown caulk	NA	ND	ND
RCSD-ASB-19	**13**	**Exterior**	**Window pane**	**Black caulk**	**NA**	**2.7**	**NA**
RCSD-ASB-20	14	Exterior	Around conduit wall penetration	Black putty	NA	ND	ND
RCSD-ASB-21	8	Exterior	Conduit junction box	Black gasket	NA	ND	ND
RCSD-ASB-22	12	Exterior	Around door frame	Brown caulk	NA	ND	ND

TABLE 1: SUMMARY OF ASBESTOS ANALYSIS – CONT'D

Sample ID	*HMG*	*Area*	*Sample Location*	*Material Description*	*Analytical Results (%)*		
					PLM	PLM-NOB	TEM
RCSD-ASB-23*	**13**	**Exterior**	**Window pane**	**Black caulk**	**NA**	**NA**	**NA**
RCSD-ASB-24	14	Exterior	Around conduit wall penetration	Black putty	NA	ND	ND
RCSD-ASB-25	15	Exterior	Around vent	White caulk	NA	ND	ND
RCSD-ASB-26	16	Exterior	Wall corner seam	White caulk	NA	ND	ND
RCSD-ASB-27	16	Exterior	Around vent	White caulk	NA	ND	ND
RCSD-ASB-28	17	Exterior	Around door frame	Tan caulk	NA	ND	ND
RCSD-ASB-29	17	Exterior	Wall seam	Tan caulk	NA	ND	ND
RCSD-ASB-30	2	Exterior	Brick wall	Grey mortar	ND	NA	NA
RCSD-ASB-31	1	Electrical Room	CMU wall	Grey mortar	ND	NA	NA
RCSD-ASB-32	4	Electrical Room	Around conduit wall penetration	Grey mortar	ND	NA	NA
RCSD-ASB-33	18	Roof	Top layer of vent flashing	Black rubber	NA	ND	ND
RCSD-ASB-34	19	Roof	Underneath flashing top layer	Brown mastic	NA	ND	ND
RCSD-ASB-35	20	Roof	Fan unit flashing	White caulk	NA	ND	ND
RCSD-ASB-36	21	Roof	Flashing corner seam	Black tar	NA	ND	ND
RCSD-ASB-37	20	Roof	Fan unit flashing	White caulk	NA	ND	ND
RCSD-ASB-38	18	Roof	Top layer of vent flashing	Black rubber	NA	ND	ND
RCSD-ASB-39	19	Roof	Underneath flashing top layer	Brown mastic	NA	ND	ND
RCSD-ASB-40	21	Roof	Flashing corner seam	Black tar	NA	ND	ND
RCSD-ASB-41	22	Exterior	Ceramic component in transformer	Black insulation material	ND	NA	NA
RCSD-ASB-42	22	Exterior	Ceramic component in transformer	Black insulation material	ND	NA	NA

Notes:
(1) Samples collected at the Mechanical Screen Building by Bidwell Environmental in May and June 2023.
(2) Materials containing more than 1% asbestos are considered asbestos containing materials. Items in **bold** are asbestos-containing materials.
ND - No asbestos detected.
NA - Not analyzed.
HMG - Homogenous materials group. Samples with the same HMG are considered representative of that substrate. The lab stops analysis of the HMG at first positive detection, therefore all other samples of that HMG are considered to be asbestos-containing.

TABLE 2: ESTIMATED QUANTITIES AND CONDITION OF KNOWN ASBESTOS CONTAINING MATERIALS

Material Description	*Location*	*Sample ID*	*Quantity*	*Condition*	*Friability*
Black caulk on window pane	Mechanical Screen Building, Exterior	RCSD-ASB-19 RCSD-ASB-23	45 ft^2 per window (5 windows)	Damaged	Non-friable

TABLE 3: INACCESSIBLE SUSPECT MATERIALS REQUIRING FURTHER INVESTIGATION

Material Description	*Location*	*Quantity*	*Comments*
Gaskets in grinder discharge pipe	Mechanical Screen Building, Dumpster Room	2 ft^2 (2 gaskets)	The gaskets were inaccessible at the time of the hazards assessment. A hazards assessment for asbestos should be performed prior to work on the grinder discharge pipe.
Below grade	Mechanical Screen Building, Screen Chamber	Unknown	The subgrade was not accessible during the hazards assessment. A hazards assessment for asbestos and other misc. hazardous materials should be performed prior to work in the subgrade.
Cloth covered wiring in transformer	Mechanical Screen Building, Exterior	20 linear ft	The wiring was inaccessible at the time of the hazards assessment. A hazards assessment for asbestos should be performed prior to work on the transformer wiring.

SECTION 02 83 33

REMOVAL AND DISPOSAL OF LEAD CONTAINING MATERIALS

PART 1 – GENERAL

1.01 SUMMARY

A. This Section details the minimum acceptable requirements for construction and demolition activities affecting materials and structures coated with or containing lead as identified in Tables 1 and 2 provided at the end of this Section.

B. All Work under this Contract shall be performed using methods, tools, and equipment that have demonstrated effectiveness in preventing lead emissions from migrating outside of the regulated abatement work area when used in accordance with manufacturer's recommendations. Contract work shall be performed to minimize the creation of airborne dust; minimize the quantity of hazardous waste generated; protect the health and welfare of all site personnel and the public; and avoid adverse environmental impacts.

C. The Contractor shall perform the abatement and disposal of additional materials and structures coated with or containing lead not shown on the Contract Drawings (i.e., unforeseen conditions). These abatement and disposal activities shall be performed in accordance with this Section and applicable federal, state, and local regulations.

D. Many of the painted surfaces have been analyzed, and the lead concentrations are included in Table 1 and Table 2, attached. The Contractor shall be aware that the paint contains lead and shall include in their Lump Sum Bid, the cost for development and implementation of a written lead control program for abatement, demolition, and disposal in accordance with OSHA’s Lead in Construction Standard (29 CFR 1926.62) and other applicable federal, state, and local regulations. All documentation required by this Section must be submitted to the Owner after the bid opening, within the time limits to be set by the Owner. Failure to submit this information within the specified time period may result in a disqualification of the Contractor’s bid.

E. The Contractor shall conduct work in accordance with General Contract Condition 56 Hours of Work.

F. The Contractor shall perform all Work under this Section without damaging or contaminating adjacent areas to where the work is being performed. Where such areas are damaged or contaminated, as determined by the Owner, the Contractor shall restore the areas to their original condition at no additional cost to the Owner.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 20 00 – Measurement and Payment

B. Section 01 35 45 – Hazardous Materials Control

C. Section 01 73 00 – Demolition and Execution of Work

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. The Contractor shall comply with all applicable regulations, standards, and guidelines of federal, state, and local environmental and occupational safety and health agencies regarding lead paint/coatings, lead dust, lead-containing materials, and lead wastes. These regulations, standards, and guidelines include, but are not limited to the following:

1. American Society for Testing and Materials (ASTM):

    a. Method E1553-93 – Standard Practice for Collection of Airborne Particulate Lead During Abatement and Construction Activities

2. Department of Transportation (DOT):

    a. 49 CFR 171 – General Information, Regulations, and Definitions

    b. 49 CFR 172 – Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements

    c. 49 CFR 173 – Shippers: General Requirements for Shipments and Packaging

    d. 49 CFR 178 – Specifications for Packagings

3. Environmental Protection Agency (EPA):

    a. 40 CFR 50 – National Primary and Secondary Ambient Air Quality Standards

    b. 40 CFR 116 – Designation of Hazardous Substances

    c. 40 CFR 117 – Determination of Reportable Quantities for Hazardous Substances

    d. 40 CFR 260 – Hazardous Waste Management Systems: General

    e. 40 CFR 261 – Identification and Listing of Hazardous Waste

    f. 40 CFR 262 – Standards Applicable to Generators of Hazardous Waste

    g. 40 CFR 263 – Standards Applicable to Transporters of Hazardous Waste

    h. 40 CFR 264 – Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

i. 40 CFR 265 – Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

j. 40 CFR 268 – Land Disposal Restrictions

k. 40 CFR 302 – Designation, Reportable Quantities, and Notification

l. 40 CFR 745 – Lead-Based Paint Poisoning Prevention in Certain Residential Structures

4. National Institute for Occupational Safety and Health (NIOSH):

a. Method 7082 – Lead by Flame AAS

b. Method 7105 – Lead by GFAAS

c. Method 7300 – Elements by ICP

5. New York State Department of Environmental Conservation (NYSDEC):

a. 6 NYCRR 364 - Waste Transporter Permits

b. 6 NYCRR 370 – Hazardous Waste Management Regulations

c. 6 NYCRR 371 – Identification and Listing of Hazardous Waste

d. 6 NYCRR 372 – Hazardous Waste Manifest System and Related Standards for Generators, Transporters, and Facilities

e. 6 NYCRR 373 – Hazardous Waste Management Facilities

f. 6 NYCRR 376 – Land Disposal Restrictions

6. Occupational Safety and Health Administration (OSHA):

a. 29 CFR 1910 – Occupational Safety and Health Standards for General Industry

b. 29 CFR 1910.28 – Safety Requirements for Scaffolding

c. 29 CFR 1910.120 – Hazardous Waste Operations and Emergency Response

d. 29 CFR 1910.134 – Respiratory Protection Standard

e. 29 CFR 1910.1200 – Hazard Communication Standard

f. 29 CFR 1926 – Safety and Health Regulations for Construction

g. 29 CFR 1926.62 – Lead in Construction Standard

7. Society for Protective Coatings (SSPC):

a. SSPC-Guide 6 – Guide for Containing Debris Generated During Paint Removal

b. SSPC-Guide 7 – Guide for the Disposal of Lead-Contaminated Surface Preparation Debris

c. SSPC-SP COM – Surface Preparation Commentary for Steel and Concrete

d. SSPC-SP 1 – Solvent Cleaning

e. SSPC-SP 2 – Hand Tool Cleaning

f. SSPC-SP 3 – Power Tool Cleaning

g. SSPC-SP 11 – Power Tool Cleaning to Bare Metal

h. SSPC-SP 13/ NACE No.6 – Surface Preparation of Concrete

8. Underwriters Laboratories, Inc. (UL):

a. UL 586 – Standard for Safety High Efficiency, Particulate, Air Filter Units.

1.04 SUBMITTALS

A. Within ten (10) business days of the “Notice to Proceed”, the Contractor shall submit the following to the Engineer:

1. Analytical Laboratory Qualifications for Analyzing Air and Waste Samples: Submit the name, address, and telephone number of each analytical laboratory selected to perform the analyses of all waste samples and air samples collected for area monitoring and exposure monitoring purposes. The analytical laboratory shall be currently accredited by the American Industrial Hygiene Association (AIHA), the EPA’s Environmental Lead Laboratory Accreditation Program (ELLAP), and the NYSDOH’s Environmental Laboratory Approval Program (ELAP). Provide copies of current AIHA, ELLAP, and ELAP certificates along with date(s) of accreditation/reaccreditation. ELAP certificates should show evidence of certification for the analytical method(s) that will be used to analyze each type of sample (i.e., air or waste).

2. Lead Inspection and Sampling Plan: Unless the presence of lead is presumed, the Contractor shall provide a Lead Inspection and Sampling Plan to investigate any

additional (e.g., previously inaccessible or unsampled) suspect lead-containing materials as shown on Table 2 attached, and collect confirmatory and additional samples, as appropriate during the inspection. The Lead Inspection and Sampling Plan shall include at a minimum:

a. Credentials of the individual responsible for inspection and sampling. At a minimum, the inspection shall be performed by an Environmental Professional who has current Lead Awareness, OSHA 10-hour, and confined space trainings, as applicable to the location of the work, and has performed inspection work on at least three (3) projects of comparable scope.

b. Credentials of the laboratory providing sample analysis. The credentials shall include current certification by the New York State Department of Health's (NYSDOH) Environmental Laboratory Approval Program (ELAP).

c. Sample collection, analysis, and reporting protocol.

d. Health and safety protocol (Job Hazard Analysis) for all investigative activities.

3. Lead Inspection Report: The Contractor shall provide a Lead Inspection Report prepared by the Environmental Professional summarizing the results of all inspection activities, and as applicable, a sampling narrative, laboratory data packages and inventory of all identified suspect and confirmed lead-containing materials.

4. Lead Control Plan: The Contractor shall submit a detailed, project-specific plan of work procedures to be used during abatement and demolition activities affecting lead paints/coatings, lead dusts, lead-containing materials, and lead wastes. The plan shall be prepared in accordance with the OSHA Lead in Construction Standard (29 CFR 1926.62) and all other pertinent federal, state, and local regulations. In addition, the plan shall be signed by a Certified Industrial Hygienist (CIH) meeting the qualifications set forth in Article 1.06G of this Section. The Lead Control Plan shall include the following:

a. Drawings showing the location and details of each lead control area, hygiene facility, proposed electrical hookups, proposed water hookups, restroom area, and area designated for eating, drinking, and smoking;

b. A detailed discussion regarding the interfacing of trades (i.e., how the Contractor will coordinate lead removal, handling, demolition, cleanup, and disposal activities with other contractors or Owner's employees working at the site) and the sequencing of lead-related work;

c. A detailed discussion regarding the collection, filtering, and disposal of wastewater;

d. A detailed discussion regarding the collection, handling procedures, and disposal of lead-containing materials and lead wastes;

e. A detailed discussion regarding the methodologies that will be used to conduct exposure monitoring and area monitoring activities. Also, provide the name and qualifications (i.e., training and experience documentation) of the Air Sampling Technician who will be responsible for conducting the air monitoring activities. The Air Sampling Technician shall at a minimum, satisfy the requirements set forth in Article 1.07D.5 of this Section;

f. A detailed discussion of housekeeping practices to be used for maintaining clean work lead control areas and clean hygiene facilities;

g. A detailed discussion regarding the specific methods and procedures of emissions control, which will be used to ensure that airborne lead concentrations of 30 µg/m3 of air are not met or exceeded outside of each lead control area. The discussion shall include a detailed description of engineering plans and studies that were used to determine the method(s) selected for controlling exposures to lead;

h. A detailed task analysis for each work activity that has the potential to disturb lead paints/coatings, lead dusts, lead-containing materials, and/or lead wastes. Each task analysis shall include, but is not limited to, the following information:

    1) The type of work activity;

    2) The tools/equipment that will be used;

    3) Operation and maintenance practices and procedures that will be used for the tools/equipment;

    4) The type(s) of lead-containing materials and/or wastes that may be disturbed when performing the activity;

    5) The engineering controls that will be used to control the spread of lead contamination during the activity;

    6) The proposed crew size for the activity and individual employee responsibilities during the activity;

    7) Housekeeping procedures that will be used during the activity;

    8) Protective work clothing, Personal Protective Equipment (PPE), and proposed respiratory protection that will be used for the activity;

i. A detailed schedule for the implementation of the Lead Control Plan elements. The schedule shall clearly indicate the starting and completion dates for each lead project, and shall allow adequate time for cleanup, inspections, and air monitoring activities;

j. An administrative control schedule (if anticipated or if necessary);

k. The name and qualifications (i.e., experience and training documentation) of the Competent Person who will be responsible for the oversight and execution of the Lead Control Plan during activities affecting lead paints/coatings, lead dusts, lead-containing materials, and lead wastes. At a minimum, the Competent person shall satisfy the requirements set forth in 1.07D.2 of this Section.

5. Rental equipment notification as defined in Article 2.01C of this Section.

6. Waste Management Plan: The execution of the Waste Management Plan must be coordinated with the Owner Personnel. The Waste Management Plan shall comply with all applicable federal, state, and local hazardous materials/waste regulations, and address the following:

a. The identification of Lead-containing materials, Lead wastes, and hazardous materials/wastes (as defined in 40 CFR 261 and 6 NYCRR 371) associated with the work;

b. The estimated quantity of each waste stream that will be generated and disposed of or recycled;

c. The names, addresses, phone numbers, and qualifications of each vendor and facility that will be transporting, storing, testing, and/or disposing of the wastes. The Contractor shall verify the permit status of the facility as well as check for outstanding violations and enforcement actions. Include a 24-hour phone contact for each vendor/facility. In addition, provide copies of current federal, state, and local hazardous waste permits;

d. Current permit documentation for each recycling facility or TSDF indicating that the facility is approved by federal, state, and local regulatory agencies to receive Lead-Containing Materials and Lead Wastes. The documentation shall include an “acceptance letter” from each TSDF indicating its ability to accept the specific waste streams that will be generated during Work performed under this Section;

e. Current 6 NYCRR 364 permit documentation for the waste transporter that will transport Lead-Containing Materials and Lead Wastes from the work Site to the TSDF. The documentation shall clearly indicate the transporter’s

ability to deliver the Lead-Containing Materials and Lead Wastes to the chosen TSDF;

f. The name and qualifications (i.e., experience and training documentation) of the Hazardous Waste Manager who will be responsible for the oversight and execution of the Waste Management Plan. At a minimum, this individual shall at a minimum, satisfy the requirements set forth in Article 1.07D.3 of this Section;

g. A list of waste handling equipment to be used in performing the work, including but not limited to, cleaning, volume reduction, and transport equipment;

h. Spill prevention, containment, and cleanup contingency measures to be implemented during the work;

i. A detailed discussion of the on-site storage, handling, removal, and disposal of waste materials. This discussion shall include, but is not limited to the following:

1) Specifications for a secondary containment system;

2) The methods of demarcation that will be used to identify the waste storage area(s) and each waste container;

3) The methods and procedures that will be used to collect and containerize hazardous wastes on a daily basis;

4) The types of containers that will be used to containerize the wastes;

5) The posting of weekly waste inspection and inventory records as defined in Paragraph B.2 of this Article.

7. Chemical Analysis and Safety Data Sheets (SDS): Provide Chemical Analysis and Safety Data Sheets (SDS) for all chemical products (including chemical stripping products) to be used in the work. Show by copy of transmittal form, that a copy of each SDS has been transmitted to the Competent Person, who will be responsible for the execution and oversight of the Lead Control Plan and the Hazardous Waste Management Plan, prior to the start of any work activities.

8. Equipment List: Identify the equipment that will be used to control, remove, collect, and containerize the lead paints/coatings, lead dusts, lead-containing materials, and lead wastes generated during abatement, handling, transportation, housekeeping, disposal, and demolition activities. It should be noted that even after paint/coatings removal, the Owner has found that demolition activities (e.g., torch-cutting abated steel) still have the potential to generate elevated airborne

levels of lead. Therefore, the Contractor should include in his lump sum bid, engineering controls to capture potential lead dusts and/or fumes emitted during demolition work that involves the cutting or burning of steel structures that have already been abated.

9. Training and Experience: For all activities that result in airborne lead concentrations equal to, or in excess of the Action Level, or for those activities that take place within a lead control area, the Contractor shall submit for this Contract a sufficient number of properly trained and experienced Lead Workers, each of whom shall:

    a. Have completed lead awareness training in accordance with Article 1.06Q of this Section within the past year;

    b. Meet the experience requirements set forth in Article 1.07D.4 of this Section.

10. Medical Surveillance: For all activities that result in airborne lead concentrations equal to, or in excess of the Action Level, or for those activities that take place within a lead control area, the Contractor shall submit for this Contract a sufficient number of properly trained and experienced workers, each of whom shall:

    a. Have completed initial blood testing (including zinc protoporphyrin (ZPP) testing), and have a blood lead level (BLL) below 35 micrograms per deciliter (µg/dl)(if the worker's BLL is in excess of 35 µg/dl, the worker shall show medical approval for this work);

    b. Have received a medical exam that included a Pulmonary Function Test (PFT) within the past year;

    c. Have received written medical clearance within the past year, by a licensed physician, to wear a respirator;

    d. Have received a qualitative or quantitative respirator fit test for the specific respirator the employee will be using for this work within the past year.

11. Documentation: Documentation for each employee shall be provided to the Owner including:

    a. Dates and written proof of lead and/or hazardous waste training (e.g., certificates) in accordance with Article 1.07D of this Section for Lead Workers, Competent Persons, Hazardous Waste Managers, and Air Sampling Technicians that will be used for each lead project;

    b. Copies of resumes for Lead Workers, Competent Persons, Hazardous Waste Managers, and Air Sampling Technicians that will be used for each

lead project, indicating work experience as defined in Article 1.07D of this Section;

c. Dates and written proof of initial medical surveillance by the Contractor or other employer within the past year, and proof that the employee is currently participating in the employer's ongoing medical surveillance program in accordance with Paragraph 10 of this Article;

d. Dates and written proof of respiratory clearance and a medical exam in accordance with Paragraph 10 of this Article;

e. Dates and written proof of a respirator fit test in accordance with Article Paragraph 10 of this Article.

12. A signed and notarized statement disclosing all of the Contractor's OSHA and EPA citations on lead projects within the past three (3) years. If the Contractor will be using a subcontractor, a signed and notarized statement disclosing all of the subcontractor's OSHA and EPA citations on lead projects within the past three (3) years will also be required.

B. Field Reports, Records, and Health and Safety Programs: During all operations under this Contract, the Contractor shall maintain and provide the following documentation:

1. Air Monitoring Documentation: All air monitoring results and daily air monitoring reports shall be provided to the Owner within 24 hours of the date the samples are collected. The results shall be signed by the laboratory employee(s) who analyzed or supervised the analysis of the sample(s), as well as the Air Sampling Technician who physically performed the air monitoring activities at the project site. All laboratory analytical results shall be accompanied by complete chain-of-custody documentation.

a. Each daily air monitoring report shall be signed by the Contractor's Employee who generated the report. The content of these reports shall include, but is not limited to, the following information:

1) Sample "start" and "stop" times;

2) Flow rates (initial and final) for each sample;

3) The total volume of air collected for each sample;

4) Sample location descriptions/ sample location drawings/ names of individuals being sampled;

5) Types (i.e., makes and models) of sampling equipment used;

6) Types of sample media (i.e., filters and cassettes) used;

7) The most recent calibration dates, along with the calibration results, for the sampling equipment used;

8) Name of the Air Sampling Technician that conducted the air monitoring;

9) Date(s) that the air monitoring was conducted;

10) Work tasks being performed during the sampling;

11) Sample numbers used to identify each sample.

2. Hazardous Waste Documentation: Completed and signed hazardous waste manifests from Treatment, Storage, and Disposal (TSD) facilities shall be provided to the Owner within ten (10) days of disposal. In addition, on-site hazardous waste storage area(s) shall be inspected weekly by the Hazardous Waste Manager, who at a minimum satisfies the requirements set forth in Article 1.07D.3 of this Section.

a. Each weekly hazardous waste storage area inspection shall be documented in the form of a written report, and each report shall be signed by the Contractor's employee who generated the report. All reports shall be provided to the Owner within 24 hours of the date the inspection is completed. The content of these reports shall include, but is not limited to, the following information:

1) The name of the individual that conducted the inspection;

2) Descriptions of waste streams being stored;

3) Types and quantities of waste containers being used;

4) The current disposal status (i.e., when the waste container is scheduled to be removed from the work site) and physical condition of each waste container;

5) The condition of each waste storage area;

6) The presence/absence of proper labeling for each waste container in accordance with Article 3.01F of this Section and federal, state, and local regulations, including 29 CFR 1926.62;

7) Secondary containment(s) being used;

8) The methods being used to secure each waste storage area and prevent any unauthorized entry;

9) The presence of any waste containers on site generated during the work performed under the Contract, that violate RCRA generator storage time limitations, as defined in 40 CFR 262.

b. In addition to performing weekly hazardous waste storage area inspections, the Hazardous Waste Manager shall also maintain an ongoing hazardous waste inventory record. The content of the inventory record shall include, but is not limited to, the following information:

1) Specific dates that each waste container was added and/or removed from the hazardous waste storage area;

2) The full name (printed) and signature of the individual responsible for adding and/or removing each waste container from the hazardous waste storage area.

3. Lead Control Area Inspection Documentation: Lead control areas shall be inspected daily by the Competent Person, who at a minimum, shall satisfy the requirements set forth in Article 1.07D.2 of this Section.

a. Each daily lead control area inspection shall be documented in the form of a written report, and each report shall be signed by the Contractor's employee who generated the report. All reports shall be provided to the Owner within 24 hours of the date the inspection is completed. The content of these reports shall include, but is not limited to, the following information:

1) Type(s) of lead work being performed;

2) Full names of Lead Workers, Competent Persons, Hazardous Waste Managers, and Air Sampling Technicians on site, as well as the name of the company each individual is representing;

3) Types of air monitoring being conducted and the number of samples being collected for each type of air monitoring activity;

4) Any non-compliance issues observed (i.e., observations that conflict with the requirements of the Contractor's Lead Control Plan, the Contractor's Hazardous Waste Management Plan, this specification, and/or federal, state, and local regulations) along with the corrective actions that were taken to achieve compliance.

4. Contractor Project Record: The Contractor's Competent Person shall maintain a project record at the work site. The project record shall be made available to the

Engineer or Owner for review at any time during the lead project and shall be submitted to the Owner within 24 hours after the completion of the lead project.

a. At a minimum, the project record shall contain the following information:

1) Copies of lead training certificates for all individuals working on the lead project;

2) Copies of all air monitoring results generated during the lead project;

3) Copies of all available paint chip sample and/or XRF analytical data, as well as lead paint inspection reports relating to the lead project;

4) Copies of all daily sign-in sheets as defined in Paragraph 5 of this Article;

5) A list of emergency phone numbers, including the local fire department, local police department, nearest hospital, as well as phone numbers for the Engineer and Owner personnel responsible for the administration of the lead project;

6) A copy of the OSHA Lead in Construction Standard (29 CFR 1926.62);

7) Copies of all Safety Data Sheets (SDS) pertaining to all chemicals being used during the lead project;

8) A copy of this Section;

9) A copy of the Contractor's Lead Control Plan;

10) A copy of the Contractor's Hazardous Waste Management Plan;

11) Copies of all daily lead control area inspection records as defined in Paragraph 3 of this Article;

12) Copies of all weekly hazardous waste storage area inspection records as defined in Paragraph 2 of this Article;

13) A copy of the hazardous waste inventory record as defined in Article Paragraph 2 of this Article;

5. Daily Sign-In Sheets: The Contractor shall generate daily sign-in sheets for all individuals entering and exiting each lead control area, for the duration of the lead project. The daily sign-in sheets shall be maintained by the Competent Person and shall be made available to the Engineer or Owner for review at any time during the

lead project. All daily sign-in sheets shall be submitted to the Owner within 24 hours after the completion of the lead project.

a. At a minimum, each daily sign-in sheet shall include:

1) The individual's full name (printed);

2) The individual's signature;

3) The name of the company the individual is representing;

4) The time of entry and exit from the area(s);

5) Verification by the Competent Person that the individual meets the minimum training requirements defined in Article 1.06Q of this Section, if the individual intends to enter a lead control area.

6. Hazard Communication Program: The Contractor shall establish and implement a Hazard Communication Program as required by 29 CFR 1910.1200.

1.05 PAYMENT

A. All costs associated with the removal and disposal of suspect/confirmed lead-containing materials and resulting wastes as shown in Table 2 attached, and unforeseen lead-containing materials, lead painted/coated materials, and resulting lead wastes that are not identified in Table 1 and Table 2 shall be reimbursed under a Hazardous Materials Allowance, as specified in Section 01 20 00 – Measurement and Payment.

B. Except for the allowance specified herein, no separate payment will be made for performing any other Work required under this Section and the Contractor shall include all costs thereof in the Lump Sum Bid, as specified in Section 01 20 00 – Measurement and Payment.

C. Payment under Lump Sum Bid for the disposal of lead wastes (with the exception of scrap metal) will not be made until a signed copy of the manifest from the Treatment, Storage, and Disposal (TSD) facility, certifying the amount of lead-containing materials, lead painted/coated materials, and lead wastes delivered is returned with complete chain-of-custody documentation to the Owner.

D. The Owner will inspect the work performed, review the costs, and approve or reject requests for payment as provided by the General Conditions.

1.06 DEFINITIONS

A. Abatement: Defined by the EPA (40 CFR 745.223) as any measures or set of measures designed to permanently eliminate lead paint hazards. Abatement includes, but is not

limited to, the removal of lead paint and dust, the permanent enclosure or encapsulation of lead paint, or the replacement of lead-painted surfaces or fixtures.

B. Action Level: Defined in the OSHA Lead in Construction Standard (29 CFR 1926.62) as employee exposure, without regard to the use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air (30 ug/m3) calculated as an 8-hour Time-Weighted Average (TWA). Once the Action Level is met or exceeded, the Contractor is responsible for meeting specific requirements outlined in 29 CFR 1926.62, which may include additional worker exposure monitoring, the use of Personal Protective Equipment (PPE) including respiratory protection, the use of hygiene facilities, medical monitoring, and/or training for workers.

C. Amended Water: Water to which a surfactant/wetting agent has been added in order to increase the liquid's ability to adhere to dust and prevent the dust from becoming airborne.

D. Area Monitoring: Stationary air sampling inside and outside the lead control area for the purpose of determining compliance with OSHA's Lead in Construction Standard (29 CFR 1926.62), and for the purpose of ensuring that airborne lead concentrations remain below 30 ug/m3 outside of the lead control area during all work activities that have the potential to disturb lead-containing materials, lead paints/coatings, lead dusts, or lead wastes. For the purpose of this Section, all area monitoring shall follow a pertinent NIOSH or ASTM sampling methodology (e.g., NIOSH 7082, NIOSH 7105, NIOSH 7300, ASTM E1553-93, etc.).

E. Atomic Absorption (AA): An EPA-approved laboratory analytical method for determining the lead content of a given sample.

F. C-3/C-5 Supervisor Competent Person Training for Deleading of Industrial Structures: A training course administered by the Society for Protective Coatings (SSPC) or a company that has been approved by the SSPC as a "trainer," which includes discussions of the following: (a) background information on lead and other toxic metals; (b) a legal and regulatory overview; (c)worker protection from lead and other toxic metals; (d) compliance with air, soil, water/sediment, and dust regulations; (e) management of solid and hazardous waste; (f) sources of lead exposure; (g) control of environmental releases; (h) specifications and site-specific compliance plans; (i) work site preparation; (j) insurance and bonding issues; (k) other safety and health hazards.

G. Certified Industrial Hygienist (CIH): Refers to an Industrial Hygienist employed by the Contractor who is currently certified by the American Board of Industrial Hygiene (AHIA) in comprehensive practice.

H. Competent Person: Defined in the OSHA Lead in Construction Standard (29 CFR 1926.62) as one who is capable of identifying existing and predictable lead hazards in the surroundings or working conditions, and who has authorization to take prompt

corrective measures to eliminate them. The Competent Person shall also fulfill the requirements stated in Article 1.07D.2 of this Section.

I. Decontamination Area: Designated area within the hygiene facilities for removing gross contamination from the body (e.g., using a HEPA vacuum), washing away (with soap and water) contamination that has accumulated on the skin and hair, removing and disposing/washing of contaminated protective work clothing and contaminated Personal Protective Equipment (PPE), and donning clean clothing that will not potentially contaminate areas outside of the lead control area's physical boundary.

J. Exclusion Zone: (See definition of "Lead Control Area").

K. Exposure Monitoring: Personal air sampling performed outside the respirator within the breathing zone of individual employees, for the purpose of determining compliance with OSHA's Lead in Construction Standard (29 CFR 1926.62), including the selection of appropriate respiratory protection for individuals within a lead control area. For the purpose of this Section, exposure monitoring samples shall be collected from individuals who are representative of each type of work task being conducted by the Contractor, and all exposure monitoring shall follow a pertinent NIOSH or ASTM sampling methodology (e.g., NIOSH 7082, NIOSH 7105, NIOSH 7300, ASTM E1553-93, etc.).

L. Hazardous Waste Operations (HAZWOPER) Training: Training that meets the criteria outlined in the OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120).

M. High Efficiency Particulate Air (HEPA) Filter: A filter designed to remove 99.97% of all particles greater than 0.3 micrometers (μm) in diameter. For the purpose of this Section, HEPA vacuum and local exhaust filtration equipment used by the Contractor shall meet the Standard for Safety High-Efficiency, Particulate, Air Filter Units (UL 586) developed by Underwriters Laboratories.

N. Hygiene Facilities: Facilities within the physical boundary of the lead control area meeting the requirements set forth in the OSHA Lead in Construction Standard (29 CFR 1926.62), which are set up to prevent cross-contamination and are equipped with change areas, separate storage facilities for protective work clothing, Personal Protective Equipment (PPE), and street clothes. The hygiene facilities will also include adequately supplied hand washing station(s) and/or shower(s) (i.e., warm and cold water at the tap, clean towels, soap, and shampoo) as necessary to comply with 29 CFR 1926.62.

O. Inductively Coupled Plasma (ICP): An EPA-approved laboratory analytical method for determining the lead content of a given sample.

P. Lead: Defined in the OSHA Lead in Construction Standard (29 CFR 1926.62) as metallic lead, all inorganic lead compounds, and organic lead soaps. Excluded from this definition are all other organic lead compounds.

Q. Lead Awareness Training: Training that meets the criteria outlined in the OSHA Lead in Construction Standard (29 CFR 1926.62) for individuals that have the potential to be exposed to airborne lead concentrations at or above the Action Level on any day. This training shall include discussions of the following: (a) current federal, state, and local regulations pertaining to lead, including 29 CFR 1926.62; (b) the health effects of lead exposure; (c) state-of-the-art work practices, engineering controls, and procedures for abatement, demolition, materials handling, waste management, and housekeeping activities that involve lead paints/coatings, lead dusts, lead-containing materials, and lead wastes; (d) the use and maintenance of Personal Protective Equipment (PPE) and the use and maintenance of respirators in accordance with 29 CFR 1910.134; (e) medical surveillance programs and the medical removal protection program; (f) requirements regarding warning signs, labeling, and Material Safety Data Sheets (MSDS) in accordance with 29 CFR 1910.1200; (g) responsibilities of the Competent Person.

R. Lead-Based Paint (LBP): A term used by HUD and the EPA to define paint or other surface coatings (e.g., glazes) with lead levels equal to or exceeding 1.0 milligram per square centimeter (1.0 mg/cm^2) or 0.5 % by dry weight. LBP is subject to the requirements set forth in the OSHA Lead in Construction Standard (29 CFR 1926.62).

S. Lead-Containing Paint (LCP): A term used to define paint or other surface coatings (e.g., glazes) with any detectable amount of lead less than 1.0 milligram per square centimeter (1.0 mg/cm^2) or 0.5 % by dry weight. LCP is subject to the requirements set forth in the OSHA Lead in Construction Standard (29 CFR 1926.62).

T. Lead Control Area: The area within the physical boundary where worker hygiene facilities are located, and where all work activities take place that involve the disturbance of lead paints/coatings, lead dusts, lead-containing materials, and lead wastes.

U. Lead Paint: A general term that refers to both Lead-Based Paint (LBP) and Lead-Containing Paint (LCP).

V. Lead Project: Any form of work performed in connection with the renovation, modification, or demolition of a building or structure which will involve the abatement or disturbance of lead paints/coatings, lead dusts, lead-containing materials or lead wastes.

W. Lead Waste: Non-specific waste including water, dust, and/or debris generated during the removal, handling, cleanup, and/or demolition of lead paints/coatings, lead dusts, and/or lead-containing materials.

X. OSHA Lead in Construction Standard (29 CFR 1926.62): A federal standard that applies to all construction work where an employee may be occupationally exposed to lead. In this standard, “construction work” is defined as work for construction, alteration, and/or repair, including painting and decorating. It also includes, but is not limited to, the following: (a) the demolition or salvage of structures where lead or materials containing lead are present; (b) the removal or encapsulation of materials containing lead; (c) new construction, alteration, repair, or renovation of structures, substrates, or portions thereof, that contain lead, or materials containing lead; (d) the installation of products containing lead; (e) lead contamination/ emergency cleanup; (f) the transportation, disposal, storage, or containment of lead or materials containing lead on the site or location at which construction activities are performed; (g) maintenance operations associated with any of the construction activities described in this paragraph.

Y. OSHA Monitoring: (See definition of “Exposure Monitoring”).

Z. P-100 Filter: (See definition of: “High Efficiency Particulate Air (HEPA) Filter”).

AA. Perimeter Monitoring: (See definition of “Area Monitoring”).

BB. Permissible Exposure Limit (PEL): Defined in the OSHA Lead in Construction Standard (29 CFR 1926.62) as employee exposure, without regard to the use of respirators, to an airborne concentration of lead of 50 micrograms per cubic meter of air (50 ug/m3) calculated as an 8-hour Time-Weighted Average (TWA). Once the PEL is met or exceeded, the Contractor is responsible for meeting specific requirements outlined in 29 CFR 1926.62, which include worker exposure monitoring, the use of Personal Protective Equipment (PPE) including respiratory protection, the use of hygiene facilities, and medical monitoring and training for workers. If an employee works more than eight hours in a shift, the PEL shall be calculated by using the following formula:
PEL = 400 micrograms per cubic meter of air/hours worked per day

CC. Personal Monitoring: (See definition of “Exposure Monitoring”).

DD. Physical Boundary: A physical barrier designated with ropes, “caution tape”, and/or a partition that surrounds the lead control area, in order to limit the entry of unauthorized personnel. As used in this specification, "outside of the boundary" shall mean the same as "outside of the lead control area.”

EE. Regulated Area: (See definition of “Lead Control Area”).

FF. Resource Conservation and Recovery Act (RCRA) Training: Training that includes discussions of the following: (a) the definition of hazardous waste; (b) labeling; (c) waste storage; (d) the transportation and packaging of waste; (e) hazardous waste manifests; (f) emergency procedures.

GG. Time-Weighted Average (TWA): The average time over a given work period (e.g., an 8-hour workday) of a person's exposure to a chemical or agent. The average is determined by sampling for the chemical or agent throughout the time period.

HH. Trigger Activities: Certain activities that involve a disturbance of lead paints/coatings, lead dusts, lead-containing materials, and/or lead wastes will trigger requirements under the OSHA Lead in Construction Standard (29 CFR 1926.62). Depending upon whether the performance of these activities exceeds the Action Level or PEL, the requirements may include additional worker exposure monitoring, the use of Personal Protective Equipment (PPE) including respiratory protection, the use of hygiene facilities, and medical monitoring and/or training for workers. Examples of trigger activities include, but are not limited to the following: abrasive blasting, welding, torch cutting or burning, heat gun usage, needle gunning/scaling, rivet busting, using a rotopeen, mechanical sanding or grinding, using mechanical shears, hand scraping or sanding, chemical stripping, and the manual demolition of lead painted/coated or lead-containing materials.

II. Wipe Sampling: Environmental sampling procedure that is sometimes used to confirm the effectiveness of engineering controls intended to prevent the release of lead dusts, paint chips/coatings, lead-containing debris, and lead wastes, as well as cleanup measures following work activities and decontamination events. Any wipe sampling activities that may be performed shall follow a pertinent NIOSH or ASTM sampling methodology (e.g., NIOSH 9100, ASTM E1728, ASTM E1792, etc.).

JJ. X-Ray Fluorescence (XRF): An analytical method that can be used in the field for determining the lead content of a given building component or material surface.

1.07 QUALITY ASSURANCE

A. Scheduling: The Contractor shall coordinate and schedule all phases of the work of the Contract with the Engineer, subcontractors, material suppliers, and other parties as necessary to insure the proper execution of the work.

B. Compliance: In addition to the detailed requirements of this specification, the Contractor shall comply with all applicable regulations of federal, state, and local authorities pertaining to the removal, handling, storage, transportation, disposal, and demolition of lead paint/coatings, lead dust, lead-containing materials, and lead wastes. All matters regarding the interpretation of any regulations or standards shall be submitted to the Engineer for resolution before starting the work. Where the requirements of this specification and federal, state, or local regulations conflict or vary, the most stringent requirements or regulations shall apply.

C. Rejection of Non-Complying Items: The Owner reserves the right to reject items incorporated into the work which fail to meet the specified minimum requirements. The Owner also reserves the right to reject Contractor submittal items that are deemed inappropriate or unacceptable by the Engineer or Owner. Submittal items that may be

deemed inappropriate or unacceptable include proposed vendors or subcontractors with previous regulatory citations/violations. The Owner further reserves the right, and without prejudice to other recourse, to accept non-complying items subject to an adjustment in the Contract amount, as approved by the Owner.

D. Qualifications:

1. Contractor: The abatement/demolition Contractor shall have successfully completed at least two (2) lead projects of comparable scope and methodologies to this Contract within the past three (3) years. This experience shall be documented by identifying the following:

   a. The name, address, and phone number of each facility where the work was performed;

   b. The name of the individual representing the owner who supervised the work at each facility;

   c. The type(s) of facilities where the work was performed;

   d. The volume and type of each material that was abated and/or demolished;

   e. The specific method(s) of abatement and/or demolition used at each facility (including the tools, technologies, and engineering controls employed);

   f. The name of each Competent Person supervising the work on each project.

2. Competent Person: The Contractor shall have on staff and assigned to this Contract a Competent Person who has successfully completed both HAZWOPER and lead awareness training courses as defined in Article 1.06L and Article 1.06Q of this Section, or who has successfully completed C-3/C-5 Supervisor Competent Person Training for Deleading of Industrial Structures as defined in Article 1.06F of this Section, or who has successfully completed training as an Lead Supervisor in accordance with 40 CFR 745.225 (b)(7)(vi). Each training course shall have been completed within the past year in the form of either an initial course or a refresher course. In addition, the Competent Person shall be able to fulfill the duties defined in Article 1.06H of this specification, and have a minimum of two (2) years' experience on lead projects, have a minimum of five (5) years' experience in construction trades, and have served as the Competent Person on at least three (3) lead projects of comparable scope and methodologies to the work being conducted under this Contract.

3. Hazardous Waste Manager: The Contractor shall have on staff and assigned to this Contract a Hazardous Waste Manager who has successfully completed both HAZWOPER and RCRA training courses as defined in Article 1.06L and Article 1.06FF of this Section. Each training course shall have been completed within the

past year in the form of either an initial course or a refresher course. In addition, the Hazardous Waste Manager shall have a minimum of two (2) years' experience on projects involving hazardous wastes (including lead) and have five (5) years' experience in construction trades. It is acceptable for an individual who meets the criteria of the Competent Person to also serve as the Hazardous Waste Manager for this Contract as long as they fulfill all of the requirements of this Paragraph.

4. Lead Worker: The Contractor shall have on staff and assigned to this Contract a sufficient number of experienced and properly trained Lead Workers. Lead Workers shall have training in accordance with Article 1.04A.9 of this Section and shall have a minimum of one (1) year of experience on lead projects and have worked on at least three (3) lead projects of comparable scope and methodologies to the work being conducted under this Contract.

5. Air Sampling Technician: The Contractor shall have an Air Sampling Technician assigned to this Contract who is independent from the Contractor, and who has successfully completed a training course as defined in Article 1.06Q of this Section. This training course shall have been completed within the past year in the form of either an initial course or a refresher course. In addition, the Air Sampling Technician shall have a minimum of two (2) years' experience in conducting area monitoring and exposure monitoring on projects involving hazardous wastes (including lead). It is acceptable for an individual who meets the criteria of the Competent Person as defined in Paragraph 2 of this Article or Hazardous Waste Manager as defined in Paragraph 3 of this Article to also serve as the Air Sampling Technician for this Contract as long as he/she satisfies all of the requirements of this paragraph and is independent from the Contractor.

1.08 SPECIAL REQUIREMENTS

A. Commencement of Work: Five (5) days prior to the proposed start of work at each separate location, the Contractor shall notify the Engineer and the onsite safety staff. No work may proceed at any location until authorized by the Engineer.

B. The Contractor shall coordinate any required equipment shutdowns with the Engineer prior to starting the work.

C. Access Restrictions: The Contractor shall inform the Engineer of proposed access restrictions (i.e., areas or items of equipment which will not be accessible during the proposed lead project) and give them estimated time frames (including specific dates) of such proposed access restrictions. The Contractor shall be aware that other contractors may be at any of the work sites associated with this Contract. As a result, the Contractor shall not have exclusive rights to any work site and shall fully cooperate and coordinate this work with the work of other contractors who may be on site. Therefore, the Contractor shall notify other contractors in advance of the removal and disposal work included herein, to provide them with sufficient time for coordination of interrelated items

that are included in their contracts and that must be performed before, after, or in conjunction with the work included in this Contract.

D. Unexpected Entry into a Lead Control Area: In the event that Owner personnel must enter a lead control area for reasons unrelated to the supervision or inspection of work under this Contract (e.g., under emergency conditions), the Contractor shall immediately stop work cleanup any loose debris, so as to permit the safe entry by Owner personnel. Any disturbance of lead paints/coatings, lead dusts, lead-containing materials, and/or lead wastes that may potentially generate airborne concentrations of lead equal to or above the Action Level as defined in 29 CFR 1926.62, shall not proceed until all Owner personnel have exited from the lead control area.

E. Meetings: The Contractor shall visit and investigate the site, review the Contract Drawings, review this specification, and become familiar with any conditions which may affect the work, as part of the pre-construction meeting and site inspection. The Contractor shall hold all meetings with appropriate parties as scheduled and as otherwise necessary to accomplish the work of the Contract in accordance with its specific requirements and standards. In addition to the pre-construction meeting and site inspection, other meetings may be required or may be requested by the Engineer, including briefings with Owner Operations personnel. Written documentation (i.e., “minutes”) of all meetings shall be generated by the Contractor, and copies shall be provided to the Owner within three (3) days following each meeting.

PART 2 – PRODUCTS

2.01 EQUIPMENT

A. Respirators: Select respirators approved by the National Institute for Occupational Safety and Health (NIOSH) for use in areas where lead paint/coatings, lead dust, lead-containing materials, and/or lead wastes may be disturbed. At a minimum, the Contractor shall provide each individual within a lead control area with a half-face or full-face Powered Air Purifying Respirator (PAPR) equipped with HEPA/P-100 filter cartridges, until exposure monitoring results indicate that respiratory protection can be modified. The CIH shall make all determinations regarding respiratory protection modifications that will be used for each lead project. All modifications shall be in accordance with the OSHA Lead in Construction Standard (29 CFR 1926.62) and the Lead Control Plan.

B. Protective Work Clothing and Personal Protective Equipment (PPE): Each individual within a lead control area shall wear steel-toe, safety boots. The Contractor shall provide personnel who have a potential to be exposed to lead paint/coatings, lead dust, lead-containing materials, and/or lead wastes, with appropriate, disposable protective whole-body clothing, head coverings, plastic or rubber gloves, and foot coverings. Tape (e.g., duct tape) should be used to secure sleeves at the wrists and pants at the ankles, in

order to prevent potential lead contamination from penetrating openings in the clothing. In addition, the Contractor shall provide each individual within a lead control area with a hard hat as well as appropriate eye protection and hearing protection.

C. Rental Equipment Notification: If rental equipment is to be used during the removal, handling, storage, transportation, disposal, and/or demolition of lead paints/coatings, lead dusts, lead-containing materials, and/or lead wastes, the Contractor shall notify the rental agency in writing concerning the intended use of the equipment. All rental equipment data demonstrating compliance with the performance requirements of this Paragraph and Article 2.03 of this Section must be presented to and approved by the Engineer prior to use.

D. HEPA Filters: HEPA/P-100 filters used in vacuuming equipment, power tools, and local exhaust equipment must meet or exceed any manufacturer's specifications and recommendations, as well as specifications presented in the Standard for Safety High-Efficiency, Particulate, Air Filter Units (UL 586).

E. Waste Containers: Containers for the storage of all wastes shall be DOT-approved and shall be provided by the Contractor.

2.02 LEAD PAINTS/COATINGS REMOVAL – MECHANICAL EQUIPMENT

A. Regardless of the chosen method of paint/coating removal, the process must be repeated until the area to be cleaned is visibly free of any remaining paints/coatings. When removing paints/coatings from metal surfaces, the paints/coatings must be removed to the extent that only the bare metal remains. In the case of substrates other than metal (e.g., concrete, brick, block, etc.), paint/coatings shall be removed from the surface of the substrate to the extent that flaking and peeling will not occur subsequent to the performance of the work. Acceptance of the work shall be contingent upon inspection of the substrate surfaces by the Engineer and must demonstrate the absence of residual paint/coating layers that can be physically measured, pried loose, or peeled away using a scraping device. The Contractor may only use products and tools meeting the performance specifications outlined below:

1. The Contractor shall utilize a vacuum-assisted power tool system with demonstrated suitability and efficiency in preparing metal surfaces to the SSPC SP-11 standard, and with demonstrated effectiveness in maintaining lead emissions below 30 µg/m^3 during the disturbance of paints/coatings. Such systems may include dustless needle guns, dustless rotopeens, and dustless right angle grinders, all of which capture dust and debris at the cutting tool edge, and transport the material under vacuum conditions to an air tight disposal container. Dustless needle guns shall only be utilized on metal surfaces.

2. The vacuum-assisted power tool system shall also be designed to permit the removal and replacement of collection containers under negative pressure in order

to prevent the release of dust. The system shall be equipped with an automatic shut-off in the event of vacuum failure.

3. Abrasive/recovery tools shall be monitored at all times by a device capable of determining recovery at the face of each tool, and capable of automatically disabling the tool in the event that recovery levels are insufficient. The monitor, at a minimum, shall have the following features: (a) a remote warning light; (b) an adjustable recovery set point; (c) automatic equipment disabling capabilities; (d) a sensing range of 0-5 psi; (e) solid-state photohelic instrumentation; (f) remote sensing at the face of the tool. The safe recovery point shall be calibrated each day before start-up, or each time a new tool or vacuum source is used. All manufacturer recommendations shall be followed with respect to the set-up and use of the monitor, and the manufacturer's operations manual shall be kept on site at all times. A daily log shall be maintained by the Contractor, identifying all calibrations of recovery levels, as well as any “down time” as a result of insufficient recovery levels.

4. Abrasive/recovery tools shall not use any products containing crystalline silica, and the system shall not introduce any non-recoverable materials or utilize any cutting materials which introduce toxic or hazardous materials into the environment.

5. The cutting head of the vacuum-assisted power tool system that is used on flat surfaces must be capable of cutting to within 1-1/2" of any inside corner, molding, or edge, and may include dustless rotopeens or dustless needle guns. Tools for corners and moldings must be specifically designed for that purpose, and conform to all inside corners, outside corners, curved, flat, and angled surfaces that are to be abated under this Contract. These tools must also maintain vacuum control at the work surface/cutting head interface at all times. HEPA vacuum-shrouded needle guns may be used for non-flat surfaces in accordance with manufacturer recommendations. Vacuum-assisted finishing tools, such as right angle grinders, may be used to achieve the SSPC SP-11 standard, but may not be used for primary removal.

6. Disposal: All paints/coatings removed from material surfaces shall be disposed of in accordance with applicable federal, state and local regulations, and this specification.

7. Vacuum-assisted power tool systems meeting all of the specifications outlined herein, may be used upon the presentation and acceptance of all required performance documentation (that shows evidence of suitability for their intended use on this Contract) to the Engineer. Any tools which do not meet all of the specifications outlined herein, shall be removed from the project site immediately, and shall not be used for the work being conducted under this Contract.

2.03 LEAD PAINTS/COATINGS REMOVAL: CHEMICAL STRIPPERS

A. The Contractor shall utilize an environmentally safe chemical paint stripping system, with demonstrated suitability and efficiency in preparing cast-in-place concrete, cement, and plaster surfaces that are free of any visible residues of paints/coatings. Acceptance of the work shall be contingent upon inspection of the substrate surfaces by the Engineer and must demonstrate the absence of residual paint/coating layers that can be physically measured, pried loose, or peeled away using a scraping device. The Contractor may only use products and paint stripping systems meeting the performance specifications outlined below:

1. The Contractor shall utilize a chemical paint stripping system with a demonstrated effectiveness in maintaining lead emissions below OSHA exposure limits during the disturbance of paints/coatings. The system shall include non-alkaline or alkaline strippers that provide the lowest possible level of toxicity consistent with the type(s) of paints/coatings to be removed. Neutralization products and procedures shall be provided for all alkaline stripping systems, and no stripping system shall contain methylene chloride, and the stripping system shall be low in volatile organic compounds (VOCs). The application of all paint stripping systems shall be in accordance with manufacturer recommendations.

2. The Contractor should note that more than one product may be required to strip lead-containing paints/coatings. The use of multiple products shall be in accordance with work practices approved by the individual manufacturer of each chemical paint stripping compound.

3. All chemical paint stripping products will be presented to the Engineer for approval prior to the start of any work that will be conducted under this Contract. When presenting the products to the Engineer, they will be in the manufacturer's unopened, original containers bearing accurate information regarding the product. Also, the manufacturer’s labels on each container shall be intact and legible. In addition, Safety Data Sheets (SDS) shall be kept on-site and readily available for all products brought to the site.

4. Disposal: All paints/coatings removed from material surfaces during the chemical stripping process, shall be disposed of in accordance with applicable federal, state and local regulations, and this specification.

B. Chemical paint systems meeting all of the specifications outlined in this Paragraph may be used upon the presentation and acceptance of all required performance documentation (that shows evidence of suitability for their intended use on this Contract) to the Engineer. Any products which do not meet all of the specifications outlined herein, shall be removed from the project site immediately, and shall not be used for the work being conducted under this Contract.

PART 3 – EXECUTION

3.01 Process and Procedures

A. Protection of Existing Work to Remain: All work involving the disturbance of lead paints/coatings, lead dusts, lead-containing materials, and lead wastes must be conducted without damage to, or contamination of equipment or surfaces within the lead control area(s) or other areas adjacent to the lead control area(s). All such damage or contamination shall be immediately corrected and cleaned up by the Contractor at the Contractor's expense.

B. Prohibited Activities: Contractors shall not conduct activities that are prohibited by OSHA and EPA regulations. The following activities are prohibited, regardless of whether they are conducted subject to an exposure assessment and written compliance program:

1. Burning-off paints/coatings;

2. Using heat guns operating above 1100°F;

3. Dry machine sanding, grinding, or blasting paint without a HEPA vacuum exhaust tool;

4. Uncontained hydroblasting or high-pressure washing;

5. Welding painted/coated surfaces unless the paint/coating is removed at least 4-inches from area of heat application (per 29 CFR 1926.345(c)(1)), and local exhaust ventilation is used.

C. Test Patches: Prior to choosing the paint removal method(s) for paints/coatings, the Contractor shall perform test patches on surfaces subject to Abatement, to determine if the method(s) meet the requirements of this Section.

D. Hygiene Facilities: The Contractor shall provide functional hygiene facilities in accordance with Article 1.06N of this Section, that are appropriate for the type(s) of work being performed under this Contract. The Contractor shall ensure that employees do not leave a lead control area wearing any potentially contaminated protective work clothing or Personal Protective Equipment (PPE). Using compressed air to dislodge dust from work clothing or PPE shall be strictly prohibited.

1. Showers: The Contractor shall provide shower facilities in accordance with 29 CFR 1926.62 and Article 1.06N of this Section, for use by employees whose airborne exposure to lead is above the Permissible Exposure Limit (PEL). When shower facilities are necessary, employees are required to shower at the end of the work shift each day prior to leaving the lead control area they are working in.

E. Signs: The Contractor shall post conspicuous warning signs at all approaches to lead control areas and hazardous waste storage areas. The signs shall be located at such a distance so that personnel may read the sign and take necessary precautions before entering a lead control area or hazardous waste storage area. Signs shall comply with federal, state, and local regulations, including the requirements of the OSHA Lead in Construction Standard (29 CFR 1926.62). At a minimum, each sign shall bear the following information in English and the predominant language that is spoken by the Contractor's employees if English is not spoken:

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING

F. Labeling: The Contractor shall affix warning labels to all lead waste containers (e.g., drums, etc.). Labels shall comply with the requirements of federal, state, and local regulations, including the EPA and DOT requirements. At a minimum, each label shall bear the following information in English:

HAZARDOUS WASTE
FEDERAL LAW PROHIBITS IMPROPER DISPOSAL
HANDLE WITH CARE
[Generator Name, Address, and Telephone Number]
[Specific Contents of Container]
[EPA-Issued Generator Identification Number]
[EPA Waste Identification Number]
[Accumulation Start Date]
[Accumulation End Date]

If waste classification is pending analysis, labels shall indicate "Hazardous Waste - Pending Analysis."

G. Physical Boundary Delineation: The Contractor shall clearly delineate each lead control area and hazardous waste storage area with a physical boundary in accordance with Article 1.06DD of this Section.

H. Work Area Preparation: The Contractor shall utilize HEPA-filtered vacuums, and wet methods during the initial cleaning of each work area. Prior to removal from each work area, all movable objects and mounted objects that can be removed shall be pre-cleaned using HEPA-vacuums and wet methods. Fixed objects that must remain within each work area shall be pre-cleaned using HEPA vacuums and wet methods, and subsequently covered with 6-mil polyethylene sheeting.

I. Utilities: The temporary use of any on-site utilities shall be subject to the approval of the Owner. The Contractor shall furnish all water needed for the lead project, as well as any temporary hookups and hoses necessary to supply water to a lead control area. Also, the Contractor shall supply any necessary heating equipment and water filtration devices necessary for the work. In addition, all temporary lighting and temporary electrical service to a lead control area shall be provided by the Contractor and shall be in weather-proof enclosures and be ground fault protected.

J. Scaffolding: The Contractor shall furnish all the scaffolding of whatever type is necessary to do the work of this Contract, subject to requirements of the OSHA Safety Requirements for Scaffolding (29 CFR 1910.28), and the approval of the Engineer. Scaffolding shall be inspected after its construction but prior to use by a Contractor employee, who is an individual qualified as a Competent Person to inspect scaffoldings, as defined by OSHA.

K. Air Monitoring: Air monitoring for airborne concentrations of lead and other toxic metals to be determined by the Engineer (e.g., cadmium during demolition of cadmium-quenched bolts and pipe hangars) shall be conducted by the Air Sampling Technician in accordance with OSHA and Articles 1.06D and Article 1.06K of this Section.

1. Exposure Monitoring: For Work involving the disturbance of any detectable concentration of Lead or other heavy metals, the Contractor shall collect personal air samples from employees who are anticipated to have the greatest risk of exposure, as determined by the CIH or Competent Person. Personal air samples shall be collected during every work shift from at least one (1) employee that is representative of each type of work task that is being performed. Each personal air sample will “run” for the employee’s entire work shift in order to ensure that enough volume (of air) is collected, and an accurate 8-hour TWA can be calculated. Documentation regarding the sample numbers, specific shift when the sampling was conducted, the work task(s) that were sampled, the date(s) of sampling, the employee hours that were worked during the shift, and the total sampling time(s), shall accompany each laboratory chain-of-custody form.

2. Area Monitoring: The Contractor shall collect a minimum of two (2) area air samples outside of each lead control area on a daily basis for the duration of the lead abatement work and any work involving the disturbance (e.g., demolition) of lead paints/coatings, lead dusts, lead-containing materials, or lead wastes. During sampling activities, all air sample filter cassettes shall be positioned approximately five to six feet above the ground (in order to simulate an individual’s breathing zone) and shall not be placed immediately adjacent to obstructions (e.g., walls or columns) which may restrict the flow of air to the filter cassette. If area air monitoring indicates an emission level in excess of 30 µg/m3 of air outside a lead control area, all lead work in that area shall be stopped immediately. The Contractor shall then take immediate corrective action to reduce emission levels to below 30 µg/m3 of air, and the Contractor shall clean all adjacent areas that may

have become contaminated due to the emission. If lead abatement work or work involving the disturbance (e.g., demolition) of lead paints/coatings, lead dusts, lead-containing materials, or lead wastes is performed outside of a building/structure, or if dusts generated from the work are exhausted outside of the building/structure where the work is taking place, additional area monitoring must be performed to ensure compliance with NYSDEC ambient air quality standards. Documentation regarding the sample numbers, sample locations, the date of sampling, the employee hours that were worked during the shift, and the total sampling times, shall accompany each laboratory chain-of-custody form.

3. Documentation: Complete documentation of all air sampling activities shall be in accordance with Article **Error! Reference source not found.** of this Section.

4. The Contractor shall submit all air monitoring results to the Owner within 24 hours from when the air samples were collected.

3.02 CLEANUP AND DISPOSAL

A. Cleanup: The Contractor shall maintain all surfaces, including protective tarps and coverings within each lead control area, free of accumulations of paint chips, dusts, wastes, and debris. The Contractor shall perform housekeeping activities daily throughout each work shift and at the end of each work shift, in order to prevent any accumulation of paint chips, dusts, wastes, and debris in the lead control area(s). Dry sweeping and using compressed air to cleanup a lead control area shall be strictly prohibited. Instead, HEPA-filtered vacuums and wet methods shall be used to ensure that each lead control area remains free of visible paint chips, dust, and debris.

B. Sampling and Laboratory Analysis of Wastes: For hazardous waste determination, the Hazardous Waste Manager shall sample all potential lead-containing waste streams in accordance with 40 CFR 261 and 6 NYCRR Part 371. All waste samples shall be collected in the presence of the Engineer using the following methodology:

1. One (1) composite waste sample shall be collected for laboratory analysis from each waste drum/container that is generated. Each composite sample will be a mixture of four (4) grab samples. The first grab sample shall be collected when the drum is approximately ¼ full of waste. The second grab sample shall be collected when the drum is approximately ½ full of waste. The third grab sample shall be collected when the drum is approximately ¾ full of waste, and the fourth and final grab sample shall be collected when the drum is full of waste. Each composite sample shall be labeled and submitted to a laboratory that satisfies the requirements set forth in Article 1.04A.1 of this Section, and each composite sample shall undergo TCLP analysis for the eight (8) RCRA metals.

2. The Contractor shall also direct the laboratory to analyze each composite sample for any additional parameters that are required by the specific Treatment, Storage,

and Disposal (TSD) facility being used. Furthermore, if the waste stream is associated with the use of a chemical stripper system, the Contractor shall have the laboratory analyze each composite sample for pH and any other RCRA characteristic that may fail due to the chemical composition of the waste. The Contractor shall ensure that the laboratory being used to satisfy the requirements of Article 1.04A.1of this Section, is also capable of performing these additional analytical tests.

3. One (1) representative wastewater sample shall be collected for laboratory analysis from each drum generated. Each sample shall be collected using appropriate field sampling equipment (e.g., a pipette or bailer), and shall be labeled and submitted to a laboratory that satisfies the requirements of this Section.

C. Collection, Separation, and Containerization of Wastes: The Contractor shall collect, separate (by waste stream/waste type), and containerize lead-contaminated waste, debris, protective work clothing, Personal Protective Equipment (PPE), and containment materials on a daily basis in accordance with the Hazardous Waste Management Plan.

1. The Contractor shall store all wastes in DOT-approved container systems. No drum/container shall be filled in excess of the capacity marked on the drum/container. All drums/containers shall be sealed and covered immediately after filling, and each drum/container will have a label affixed to it in accordance with Article 3.01F of this Section. All labels shall remain intact and legible at all times.

2. No water mixed with or contaminated by hazardous waste may be released into any drain or sewer. It should be noted that a discharge of more than 1 lb. of lead into the water within a 24-hour period shall be considered a violation of the Clean Water Act and shall be treated as a “reportable quantity” in accordance with 40 CFR 117. Such a release shall be grounds for immediate termination of this Contract and the Contractor shall be liable for any fines, penalties, and/or remediation costs.

D. Nonhazardous Waste: The Contractor shall store nonhazardous wastes separately from hazardous wastes, shall provide all non-hazardous waste containers, and shall make all transportation and disposal arrangements for non-hazardous wastes in accordance with federal, state, and local regulations.

E. Storage of Wastes: The Contractor shall ensure that all drummed wastes are stored in a secondary containment system, and that each waste storage area is demarcated with a Physical Boundary. In addition, the Contractor shall post weekly waste inspections and waste inventories in the regulated waste storage area, as required in this Section, as well as the following emergency information: (a) the name and telephone number of the facility’s Emergency Coordinator; (b) the location of fire extinguishers and fire alarms; (c)

the location of spill control materials; (d) the telephone number for the fire department (unless the facility has a direct alarm).

F. Disposal of Wastes: All waste profiles for containerized wastes must be reviewed by the Engineer and signed by the Owner as generator of the waste stream(s). The Contractor shall notify the Owner at least 14 days prior to the removal of any waste drums/containers, so that the Owner can inspect the drums/containers and review the facility “Letter of Acceptance” and the advance copy of the hazardous waste manifest(s). Wastes shall be disposed of to ensure that drums/containers do not remain on the job site for more than 90 calendar days from the initial “accumulation start date” on the label affixed to the drum/container. Containers that have reached their storage capacity shall not remain on site and transportation arrangements shall be made for their immediate removal.

G. Disposal Documentation: The Contractor shall submit written evidence that the Treatment, Storage, and Disposal (TSD) facility receiving lead-containing waste is approved by federal, state, and local regulatory agencies to receive lead-containing wastes. Once all waste profiles have been completed, the Contractor shall provide the Owner a “Letter of Acceptance” issued from the TSDF indicating that the wastes will be accepted. On the date of disposal, the Contractor shall submit one (1) copy of the completed manifest, that has been signed and dated by the initial transporter in accordance with 40 CFR 262, to the Owner for signature as Generator. All hazardous waste profiles, manifests, and Land Disposal Restrictions (LDRs) must be signed by the Owner. Nonhazardous waste manifests may be signed by a designated alternate.

H. Scrap Metal Exemption for Recycling: Under 6 NYCRR 371.1(c)(7), lead-painted scrap metal can be sent to a recycling facility, rather than be discarded as hazardous waste. In order for the Owner to submit a “c7 notification” to the NYSDEC and claim the “scrap metal exemption,” the Contractor must first submit notification to their recycling facility.

3.03 SAFE WORK PRACTICES FOR DISTURBING PAINTS/COATINGS

A. Lead-containing dust and debris can be generated when drilling or sawing into paints/coatings. Therefore, both area and exposure monitoring shall be conducted and Personal Protective Equipment (PPE) shall be utilized when a mechanical disturbance (e.g., drilling or sawing) of paints/coatings will take place. Appropriate PPE may include safety glasses, disposable coveralls, plastic/rubber gloves, and respirators with HEPA/P-100 filters. The following steps shall be followed when drilling or sawing into surfaces that are painted/coated:

1. Place a 6-mil poly drop cloth on the floor underneath the area where the drilling or sawing will take place. Fasten the drop cloth to the wall with duct tape six inches above the floor so that dust will not fall between the wall and the drop cloth.

2. Place strips of duct tape over the area of the wall where the drilling or sawing will take place.

3. Mist the duct-taped area with amended water.

4. For drilling activities, drill through the wet, duct tape with a shrouded HEPA-filtered drill, and continue to mist the drill bit and any dust that accumulates on the 6-mil poly drop cloth throughout the drilling process.

5. For sawing activities, saw through the wet duct tape with a wet saw (e.g., a saw designed for ceramic tiles/blocks), or use a shrouded HEPA-filtered saw. If a shrouded HEPA-filtered saw is used, use amended water to mist the saw cut area and any dust that accumulates on the 6-mil poly drop cloth throughout the sawing process.

6. At the completion of drilling or sawing, wet wipe the drilled/sawed surface and any tools used (e.g., drill, drill bits, saw, saw blades, etc.) with the amended water to remove any loose dust and debris.

7. Once work activities have concluded, place debris (i.e., any surface wiping materials and drop cloths used, PPE, etc.), in 6-mil disposable bags. Seal these bags dispose of them as regular construction waste.

END OF SECTION

TABLE 1: SUMMARY OF LEAD ANALYSIS ON PAINTS

Sample ID	*Location*	*Sample Description*	*Substrate*	*Color*	*Lead (mg/kg)*
RCSD-PC-01	Dumpster Room	Wall	CMU	Tan	50.7
RCSD-PC-02	Dumpster Room	Grinder support	Metal	Light grey	14.1
RCSD-PC-03	Dumpster Room	Roll-up door frame	Metal	Light grey over brown	434
RCSD-PC-04	Screen Chamber	Wall	CMU	Light blue	69.2
RCSD-PC-05	Screen Chamber	Screens	Metal	Light grey	ND
RCSD-PC-06	Screen Chamber	Screen conveyor	Metal	White	25.1
RCSD-PC-07	Screen Chamber	Actuator	Metal	Grey	26.2
RCSD-PC-08	Dumpster Room	HVAC unit	Metal	Grey	395
RCSD-PC-09	Dumpster Room	HVAC unit	Insulation	Blue	9.94
RCSD-PC-10	Dumpster Room	Ceiling I beams	Metal	Tan over red	10.2
RCSD-PC-11	Exterior	Transformer	Metal	Green	150
RCSD-PC-12	Screen Chamber	Actuator	Metal	Orange over light blue	369
RCSD-PC-13	Screen Chamber	Door frame	Metal	Grey	50
RCSD-PC-14	Screen Chamber	Conduit	Metal	Grey	256
RCSD-PC-15	Screen Chamber	Actuator	Metal	Red	1.71
RCSD-PC-16	Exterior	Ballard	Concrete	Yellow	333
RCSD-PC-17	Dumpster Room	Motor	Metal	Blue	18.2
RCSD-PC-18	Electrical Room	Wall	CMU	Green	99.9
RCSD-PC-19	Electrical Room	Floor	Concrete	Grey	228
RCSD-PC-20	Electrical Room	Compressor	Metal	Green	1,170
RCSD-PC-21	Electrical Room	Electrical panel	Metal	Grey	33.4
RCSD-PC-22	Screen Chamber	I beam	Metal	Grey	60.9
RCSD-PC-23	Screen Chamber	Ceiling panel	Concrete	Tan	18.7

Notes:

(1) Samples collected at the Mechanical Screen Building by Bidwell Environmental in May and June 2023.

(2) 40 CFR 745.223 defines lead based paints as any paint containing greater than 5,000 mg/kg. However, any detected concentration of lead in paint has the potential to affect worker health and safety during certain construction activities and shall be addressed in the Contractor's health and safety protocol for the affected work.

(3) Sample results noted above are considered representative of similarly painted structures, equipment and substrates within the same general location.

(4) Contractor to verify the locations and extent of each material.

ND - Not detected

TABLE 2: INACCESSIBLE SUSPECT MATERIALS REQUIRING FURTHER INVESTIGATION

Material Description	*Location*	*Quantity*	*Comments*
Below grade	Mechanical Screen Building, Screen Chamber	Unknown	The subgrade was not accessible during the hazards assessment. A hazards assessment for lead and other misc. hazardous materials should be performed prior to work in the subgrade.

SECTION 02 84 33

REMOVAL AND DISPOSAL OF PCB

PART 1 – GENERAL

1.01 SUMMARY

A. This Section details the minimum acceptable requirements for construction and demolition activities affecting materials and structures coated with or containing polychlorinated biphenyls (PCBs) as identified in Table 1 and Table 2 included at the end of this Section, noting that PCB-containing materials were not identified, and summarized in the following report.

B. For construction and demolition activities affecting materials and structures that are also coated with lead paints or coatings, refer to Section 02 83 33 – Removal and Disposal of Lead Containing Materials. For construction and demolition activities affecting materials and structures that are also coated with asbestos-containing materials (ACM), refer to Section 02 82 33 – Removal and Disposal of Asbestos Containing Materials.

C. All work to be performed under this Section shall be performed using methods, tools, and equipment that have demonstrated effectiveness in preventing airborne emissions from migrating outside of work areas. Contract work shall be performed to minimize the creation of airborne dust; minimize the quantity of hazardous waste generated; protect the health and welfare of all site personnel and the public; and avoid adverse environmental impacts.

D. The Contractor shall perform the abatement and disposal of additional materials and structures coated with or containing PCBs not shown on the Contract Drawings (i.e., unforeseen conditions). These abatement and disposal activities shall be performed in accordance with this Section and applicable federal, state, and local regulations.

   1. Small Capacitors and Fluorescent Light Ballasts manufactured prior to 1978 may contain PCBs in their capacitors or potting materials. Unless a Fluorescent Light Ballast is marked “No PCBs” by the manufacturer, it shall be assumed that the ballast contains PCBs. All PCB-containing light ballasts and Small Capacitors shall be removed, handled, packaged, and disposed of in accordance with this Section.

   2. In the absence of analytical testing results for a specific painted/bitumastic-coated material, the material shall be classified as PCB-containing and lead-containing. If the material is caulking or has a bitumastic coating, the material shall also be classified as asbestos containing. Any unforeseen PCB, asbestos, or lead-containing paints/bitumastic coatings discovered during the Work to be performed under this Section shall be remediated as necessary to complete the Work in accordance with this Section.

E. The Contractor shall conduct work in accordance with General Contract Condition 56 Hours of Work.

F. The Contractor shall perform all work under this Contract without damaging or contaminating adjacent areas to where the work is being performed. Where such areas are damaged or contaminated, as determined by the Owner, the Contractor shall restore the areas to their original condition at no additional cost to the Owner.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 20 00 – Measurement and Payment

B. Section 01 35 45 – Hazardous Materials Control

C. Section 01 73 00 – Demolition and Execution of Work

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. The Contractor shall comply with all applicable regulations, standards, and guidelines of federal, state, and local environmental and occupational safety and health agencies regarding PCB-Containing Materials and PCB wastes. These regulations, standards, and guidelines include, but are not limited to the following:

1. United States (U.S.) Department of Transportation (DOT):

    a. 49 CFR 171 – General Information, Regulations, and Definitions

    b. 49 CFR 172 – Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements

    c. 49 CFR 173 – Shippers: General Requirements for Shipments and Packaging’s

    d. 49 CFR 178 – Specifications for Packaging’s

2. United States Environmental Protection Agency (EPA):

    a. 40 CFR 116 – Designation of Hazardous Substances

    b. 40 CFR 117 – Determination of Reportable Quantities for Hazardous Substances

    c. 40 CFR 260 – Hazardous Waste Management Systems: General

    d. 40 CFR 261 – Identification and Listing of Hazardous Waste

    e. 40 CFR 262 – Standards Applicable to Generators of Hazardous Waste

    f. 40 CFR 263 – Standards Applicable to Transporters of Hazardous Waste

g. 40 CFR 264 – Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

h. 40 CFR 265 – Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

i. 40 CFR 268 – Land Disposal Restrictions

j. 40 CFR 302 – Designation, Reportable Quantities, and Notification

k. 40 CFR 761 – Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions

l. Method 8082A (SW-846) – Polychlorinated Biphenyls (PCBs) (soxhlet extraction method 3540) by Gas Chromatography

3. National Institute for Occupational Safety and Health (NIOSH):

a. Method 5503 – Polychlorobiphenyls

4. New York State Department of Environmental Conservation (NYSDEC):

a. 6 NYCRR 364 - Waste Transporter Permits

b. 6 NYCRR 370 – Hazardous Waste Management Regulations

c. 6 NYCRR 371 – Identification and Listing of Hazardous Waste

d. 6 NYCRR 372 – Hazardous Waste Manifest System and Related Standards for Generators, Transporters, and Facilities

e. 6 NYCRR 373 – Hazardous Waste Management Facilities

f. 6 NYCRR 376 – Land Disposal Restrictions

5. Occupational Safety and Health Administration (OSHA):

a. 29 CFR 1910 – Occupational Safety and Health Standards for General Industry

b. 29 CFR 1910.28 – Safety Requirements for Scaffolding

c. 29 CFR 1910.134 – Respiratory Protection Standard

d. 29 CFR 1910.1200 – Hazard Communication Standard

e. 29 CFR 1926 – Safety and Health Regulations for Construction

f. 29 CFR 1926.1153 – Respirable Crystalline Silica

6. Society for Protective Coatings (SSPC):

   a. SSPC-Guide 6 – Guide for Containing Debris Generated During Paint Removal

   b. SSPC-Guide 7 – Guide for the Disposal of Lead-Contaminated Surface Preparation Debris

   c. SSPC-SP 1 – Solvent Cleaning

   d. SSPC-SP 2 – Hand Tool Cleaning

   e. SSPC-SP 3 – Power Tool Cleaning

   f. SSPC-SP 11 – Power Tool Cleaning to Bare Metal

   g. SSPC-SP 13/ NACE No.6 – Surface Preparation of Concrete

   h. SSPC SP 15 – Commercial Grade Power Tool Cleaning

7. Underwriters Laboratories, Inc. (UL):

   a. UL 586 – Standard for Safety High Efficiency, Particulate, Air Filter Units.

1.04 SUBMITTALS

A. Within 30 business days of the “Notice to Proceed”, or as directed by the Engineer, the Contractor shall submit the following to the Engineer:

1. Analytical Laboratory Qualifications for Analyzing Suspect PCB-Containing Materials and Wastes: Submit the name, address, and telephone number of each analytical laboratory selected to perform the analyses of waste samples (solid and liquid), air samples collected for Area Monitoring and Exposure Monitoring purposes, and paint/bitumastic coating samples collected to classify painted/coated surfaces. The analytical laboratory shall be currently accredited by the American Industrial Hygiene Association (AIHA) and the New York State Department of Health’s (NYSDOH’s) Environmental Laboratory Approval Program (ELAP). Provide copies of current AIHA and ELAP certificates along with dates of accreditation/reaccreditation. ELAP certificates must show evidence of certification for the specific analytical methods that will be used to analyze each type of sample that will be collected.

2. PCB Inspection and Sampling Plan: The Contractor shall provide a PCB Inspection and Sampling Plan to identify suspect PCBs as shown on Table 2

attached, or not otherwise sampled during Design, and collect samples, as appropriate during the inspection. This plan shall include at a minimum:

a. Credentials of the individual responsible for inspection and sampling. At a minimum, the inspection shall be performed by an Environmental Professional who has current PCB Awareness Training, OSHA 10-hour certifications and confined space training, as applicable to the location of work, and shall have performed inspection work on at least three (3) projects of similar scope.

b. Credentials of the laboratory providing sample analysis. The credentials shall include current certification by the New York State Department of Health's (NYSDOH) Environmental Laboratory Approval Program (ELAP).

c. Sample collection, analysis and reporting protocol.

d. Health and safety protocol (Job Hazard Analysis) for all investigative activities.

3. PCB Inspection Report: The Contractor shall provide a PCB Inspection Report prepared by the Environmental Professional summarizing the results of all inspection activities, and as applicable, a sampling narrative, laboratory data packages and inventory of all identified suspect and confirmed PCB-Containing Materials.

4. PCC Safe Work Practices: Each Contractor that will disturb PCB-Containing Materials with a PCB concentration less than 50 ppm during the course of Work to be performed under this Section shall submit detailed, project-specific PCB Safe Work Practices designed to protect their workers and control the spread of potential PCB contamination. Work requiring the development of PCB Safe Work Practices includes, but is not limited to, the mechanical disturbance of paints/coatings (e.g., drilling, sawing, or spot removal). The PCB Safe Work Practices shall be signed and dated by a Certified Industrial Hygienist meeting the definition in this Section, and shall include the following elements:

a. A detailed discussion regarding the procedures and methodologies that will be used to conduct Exposure Monitoring.

1) Provide the name and qualifications (i.e., training and experience documentation) of the Air Monitor who will be responsible for conducting the Air Monitoring activities. The Air Monitor shall at a minimum, satisfy the qualification requirements set forth in Article 1.07F.6 of this Section;

b. A detailed discussion regarding housekeeping procedures to be used for maintaining clean work areas and clean Hygiene Facilities;

c. A detailed task analysis for each Work activity that has the potential to disturb PCB-Containing Materials with a PCB concentration less than 50 ppm. Each task analysis shall include, but is not limited to, the following information:

1) The type of Work activity;

2) The tools/equipment that will be used;

3) Operation and maintenance practices and procedures that will be used for the tools/equipment (SSPC SP 1, 2, 3, 11, 13 and 15 as applicable);

4) The types of PCB-Containing Materials that may be disturbed when performing the activity;

5) The engineering controls that will be used to control the spread of contamination during the activity;

6) Housekeeping procedures that will be used during the activity;

7) PPE and proposed respiratory protection that will be used for the activity;

8) Equipment and Supplies: Identify the equipment and supplies that will be used to perform the Work;

9) Rental Equipment Notification: If rental equipment is to be used during the Work, the Contractor shall notify the rental agency in writing concerning the intended use of the equipment. Rental equipment data demonstrating compliance with the performance requirements of this Section must be presented to and approved by the Engineer prior to use;

10) Safety Data Sheets (SDSs): Provide SDSs for all chemical products to be used for the Work;

11) Medical Clearance for Respiratory Protection: For all activities that disturb PCB-Containing Materials with a PCB concentration less than 50 ppm, the Contractor shall provide a sufficient number of properly trained and experienced workers, each of whom shall:

a) Have received a medical exam that included a Pulmonary Function Test (PFT) within the past year;

b) Have received written medical clearance within the past year, by a licensed physician, to wear a respirator;

c) Have received a qualitative or quantitative respirator fit-test for the specific respirator the employee will be using for this Work within the past year;

12) Employee Documentation: For all activities that may disturb PCB-Containing Materials with a PCB concentration less than 50 ppm, the Contractor shall provide a sufficient number of properly trained and experienced workers, each of whom shall:

a) Have written proof of training (e.g., certificates) in accordance with the qualification requirements of this Section for workers and Air Monitors that will be used for the Work;

b) Dates and written proof of respiratory clearance and a medical exam in accordance with this Article;

c) Dates and written proof of a respirator fit-test in accordance with this Article.

5. PCB Management Plan: Each Contractor that will disturb PCB-Containing Materials with a concentration of PCBs greater than or equal to 50 ppm, and PCB Wastes during the course of Work to be performed under this Section shall submit a detailed, project-specific PCB Management Plan that addresses work procedures and equipment to be used during the disturbance, removal, handling, collection, and disposal of PCB-Containing Materials and PCB Wastes. Work requiring a PCB Management Plan includes, but is not limited to, Abatement, spot removal, and construction/demolition activities. The PCB Management Plan shall be prepared in accordance with OSHA Construction Standards and all other pertinent federal, state, and local regulations, including New York State Department of Labor (NYSDOL) (12 NYCRR 56) asbestos regulations if asbestos is present. The PCB Management Plan shall also be signed and dated by a Certified Industrial Hygienist meeting the definition in this Section.

a. If the PCB-Containing Materials or PCB Wastes that will be disturbed also contain asbestos or heavy metals, it is acceptable to integrate the PCB Management Plan elements into the relevant Asbestos Control Plan (required under Section 02 82 33 – Removal and Disposal of Asbestos Containing Materials) or Lead Control Plan (required under Section 02 83 33 – Removal and Disposal of Lead Containing Materials). PCB Management Plan elements that are integrated into an Asbestos Control Plan or Lead Control Plan must still satisfy all of the requirements of this Section. The

PCB Management Plan (or relevant Asbestos Control Plan or Lead Control Plan) shall include the following elements:

1) Drawings showing the location and details of the following:

   a) Each PCB Control Area;

   b) Each hygiene facility;

   c) Proposed electrical hookups;

   d) Proposed water hookups:

   e) Each waste storage area:

   f) Restroom areas;

   g) Areas designated for eating, drinking, and smoking;

2) A detailed discussion regarding the interfacing of trades (i.e., how the Contractor will coordinate the Work with other contractors or DEF employees working at the site) and the sequencing of PCB-related Work;

3) A detailed discussion regarding the collection, handling procedures, and disposal of PCB-Containing Materials with a PCB concentration equal to or greater than 50 ppm, and PCB Wastes (including the collection, filtering, and disposal of wastewater). If reusable equipment used during the Work will be in contact with PCB-Containing Materials or PCB Wastes, the Contractor shall submit an equipment decontamination procedure using a Performance-based Decontamination Fluid (PODF) in accordance with 40 CFR 761;

4) A detailed discussion regarding the procedures and methodologies that will be used to conduct Exposure Monitoring and Area Monitoring. Also, provide the name and qualifications (i.e., training and experience documentation) of the Air Monitor who will be responsible for conducting the Air Monitoring activities. The Air Monitor shall at a minimum, satisfy the qualification requirements set forth in Article 1.07F.6 of this Section;

5) A detailed discussion regarding housekeeping procedures to be used for maintaining clean work areas and clean Hygiene Facilities;

6) A detailed discussion regarding the specific methods and procedures of emissions control that will be used to ensure that airborne

contaminant levels do not meet or exceed an OSHA PEL outside of each PCB Control Area;

7) Detailed task analysis for each Work activity that has the potential to disturb PCB-Containing Materials with a PCB concentration equal to or greater than 50 ppm, and PCB Wastes. Each task analysis shall include, but is not limited to, the following information:

   a) The type of Work activity;

   b) The tools/equipment that will be used;

   c) Operation and maintenance practices and procedures that will be used for the tools/equipment;

   d) The types of PCB-Containing Materials that may be disturbed or PCB Wastes that may be generated when performing the activity;

   e) The engineering controls that will be used to control the spread of contamination during the activity;

   f) The proposed crew size for the activity and individual employee responsibilities during the activity;

   g) Housekeeping procedures that will be used during the activity;

   h) PPE and proposed respiratory protection that will be used for the activity;

8) Equipment and Supplies: Identify the equipment and supplies that will be used to perform the Work;

9) Rental Equipment Notification: If rental equipment is to be used during the Work, the Contractor shall notify the rental agency in writing concerning the intended use of the equipment. Rental equipment data demonstrating compliance with the performance requirements of this Section must be presented to and approved by the Engineer prior to use;

10) Safety Data Sheets (SDSs): Provide SDSs for all chemical products (including chemical stripping products and PODFs) to be used for the Work;

11) The name and qualifications (i.e., experience and training documentation) of the Competent Person who will be responsible for

the oversight and execution of the PCB Management Plan during all activities affecting PCB-Containing Materials with a PCB concentration equal to or greater than 50 ppm, and PCB Wastes. At a minimum, the Competent Person shall satisfy the qualification requirements set forth in this Section.

b. A detailed schedule for the implementation of the PCB Management Plan elements. The schedule shall clearly indicate the starting and completion dates for the Work, and shall allow adequate time for cleanup, inspections, and Air Monitoring activities.

c. Medical Surveillance: For all activities that disturb PCB Containing Materials with PCB concentrations that are greater than or equal to 50 ppm, and PCB Wastes, the Contractor shall provide a sufficient number of properly trained and experienced workers, each of whom shall:

1) Have completed initial blood testing for PCBs;

2) Have received a medical exam that included a PFT within the past year;

3) Have received written medical clearance within the past year, by a licensed physician, to wear a respirator;

4) Have received a qualitative or quantitative respirator fit-test within the past year for the specific respirator the employee will be using for this Work.

d. Employee Documentation: For all activities that result in airborne contaminant concentrations (i.e., PCBs, asbestos, or heavy metals) equal to, or in excess of an Action Level, PEL, or TLV, or for those activities that take place within a PCB Control Area, the Contractor shall provide a sufficient number of properly trained and experienced workers, each of whom shall:

1) Have written proof of training (e.g., certificates) in accordance with the qualification requirements of this Section for PCB workers, Competent Persons, PCB waste managers, and Air Monitors that will be used for the Work;

2) Copies of resumes for PCB workers, Competent Persons, PCB waste managers, and Air Monitors that will be used for the Work, indicating work experience as required in this Section;

3) Dates and written proof of initial medical surveillance by the Contractor or other employer within the past year, and proof that the employee is

currently participating in the employer's ongoing medical surveillance program in accordance with this Section;

4) Dates and written proof of respiratory clearance and a medical exam in accordance with this Section;

5) Dates and written proof of a respirator fit-test in accordance with this Section.

e. Waste Management: Waste management shall comply with all applicable federal, state, and local hazardous materials/waste regulations, and address the following:

1) The identification of PCB-Containing Materials with a PCB concentrations equal to or greater than 50 ppm, and PCB Wastes associated with the Work;

2) The estimated quantity of each waste stream (regulated and non-regulated) that will be generated and disposed of;

3) The names, addresses, phone numbers, and qualifications of each vendor and facility that will be transporting, storing, testing, and/or disposing of the wastes. The Contractor shall verify the permit status of the facility as well as check for outstanding violations and enforcement actions. Include a 24-hour phone contact for each vendor/facility. In addition, provide copies of current federal, state, and local hazardous waste permits;

4) Current permit documentation for each recycling facility and TSDF indicating that the facility is approved by federal, state, and local regulatory agencies to receive PCB-Containing Materials with a PCB concentration equal to or greater than 50 ppm and PCB Wastes. The documentation shall include an “acceptance letter” from each TSDF indicating its ability to accept the specific waste streams that will be generated during Work performed under this Section;

5) Current 6 NYCRR 364 permit documentation for the waste transporter that will transport PCB-Containing Materials with a PCB concentration equal to or greater than 50 ppm and PCB Wastes and PCB Wastes from the work Site to the TSDF. The documentation shall clearly indicate the transporter’s ability to deliver the PCB-Containing Materials and PCB Wastes to the chosen TSDF;

6) Spill prevention, containment, and cleanup contingency measures to be implemented during the Work, as well as procedures to be followed during a suspected PCB emissions/bulk material release or emergency

situation. All measures and procedures shall be in accordance with the standards referenced in this Section;

7) A detailed discussion of the on-site storage, handling, removal, and disposal of waste materials. This discussion shall include, but is not limited to the following:

a) Specifications for a secondary containment system for each drum storage area;

b) The methods of demarcation that will be used to identify the waste storage area(s) and each waste container;

c) The methods and procedures that will be used to collect and containerize hazardous wastes on a daily basis;

d) The types of containers that will be used to containerize the wastes on a daily basis;

e) The submittal of weekly regulated waste inspection and inventory records as defined in Paragraph B.2 of this Article.

8) The name and qualifications (i.e., experience and training documentation) of the PCB Waste Manager who will be responsible for the oversight and execution of the PCB Management Plan during waste management activities involving PCB-Containing Materials with a PCB concentration equal to or greater than 50 ppm, and PCB Wastes. At a minimum, the PCB Waste Manager shall satisfy the qualification requirements set forth in this Section.

6. A current (i.e., within the last month) signed and notarized statement disclosing OSHA, EPA, and DOT citations/violations within the past three (3) years for the Contractor or company performing the PCB Abatement.

B. Field Reports and Recordkeeping: During all Work performed under this Section, the Contractor shall maintain and provide the following documentation:

1. Air Monitoring Documentation: All PCB Air Monitoring results and daily Air Monitoring Reports shall be provided to the Owner as soon as possible, but no later than seven (7) calendar days from the date the samples are collected. The results shall be signed by the laboratory employee who analyzed or supervised the analysis of the samples, as well as the Air Monitor that physically performed the Air Monitoring activities at the work site. All laboratory analytical results shall be accompanied by complete chain-of-custody documentation.

a. Each daily Air Monitoring Report shall be signed by the Contractor's Employee who generated the report. The content of these reports shall include, but is not limited to, the following information:

1) Sample "start" and "stop" times;

2) Flow rates (initial and final) for each sample;

3) The total volume of air collected for each sample;

4) Sample location descriptions/ sample location drawings/ names of individuals being sampled;

5) Types (i.e., makes and models) of sampling equipment;

6) Types of sample media (i.e., filters and cassettes) used;

7) The most recent calibration dates, along with the calibration results, for the sampling equipment used;

8) Name of the Air Monitor that conducted the air monitoring;

9) Date(s) that the air monitoring was conducted;

10) Work tasks being performed during the air monitoring;

11) Unique sample numbers used to identify each sample;

12) Highlighting of all PEL exceedances.

2. Waste Documentation: Completed and signed waste manifests from Treatment, Storage, and Disposal facilities (TSDF) shall be provided to the Owner as soon as possible but no later than thirty (30) calendar days of disposal. In addition, on-site waste storage area(s) shall be inspected weekly by the PCB Waste Manager, who at a minimum shall satisfy the requirements set forth in Article 1.07F.3 of this Section.

a. Each weekly waste storage area inspection shall be coordinated with the Engineer, documented in the form of a written report, and each report shall be signed by the Contractor's employee who generated the report. All reports shall be provided to the Owner within 24 hours of the date the inspection is completed. The content of these reports shall include, but is not limited to, the following information:

1) The name of the individual who conducted the inspection;

2) Descriptions of waste streams being stored;

3) Types and quantities of waste containers being used;

4) The current disposal status (i.e., when each waste container is scheduled to be removed from the work site) and physical condition of each waste container;

5) The condition of each waste storage area;

6) The presence/absence of proper labeling for each waste container in accordance with Article 3.01C.1 of this Section and federal, state, and local regulations;

7) Secondary containment system(s) being used;

8) The methods being used to secure/lock each waste storage area and prevent any unauthorized entry;

9) The presence of any waste containers on site generated during the work performed under the Contract, that violate RCRA generator storage time limitations, as defined in 40 CFR 262.

b. Waste Inventory Record: In addition to performing weekly waste storage area inspections, the PCB Waste Manager shall also maintain an ongoing waste inventory record. The content of the inventory record shall include, but is not limited to, the following information:

1) Specific dates that each waste container was added and/or removed from the waste storage area;

2) The full name (printed) and signature of the individual responsible for adding and/or removing each waste container from the waste storage area.

3. PCB Control Area Inspection Documentation: PCB Control Areas shall be inspected daily by the Competent Person, who at a minimum, shall satisfy the requirements set forth in Article 1.07F.2 of this Section.

a. Each daily PCB Control Area Inspection shall be documented in the form of a written report, and each report shall be signed by the Contractor's employee who generated the report. All reports shall be provided to the Owner no later than 24 hours after the inspection is completed. The content of these reports shall include, but is not limited to, the following information:

1) Type(s) of work being performed;

2) Full names of PCB Workers, Competent Persons, PCB Waste Managers, and Air Monitor on site, as well as the name of the company each individual is representing;

3) Types of air monitoring (i.e., Exposure Monitoring or Area Monitoring) being conducted and the number of samples being collected for each type of air monitoring activity;

4) Any non-compliance issues observed (i.e., observations that conflict with the requirements of the Contractor's PCB Management Plan, this Section, and/or federal, state, and local regulations) along with the corrective actions that were taken to achieve compliance.

4. Contractor Project Record: The Contractor's Competent Person shall maintain a project record at the work site. The Contractor's Project Record shall be made available to the Engineer or Owner for review at any time during the Work and shall be submitted to the Owner within 24 hours after the completion of the Work.

a. At a minimum, the Contractor's Project Record shall contain the following information:

1) Copies of training certificates for all individuals involved with the Work;

2) Copies of all air monitoring results generated during the Work;

3) copies of all available caulking and paint chip/bitumastic coating sample analytical data and survey reports related to the Work;

4) Copies of all daily sign-in sheets as defined in Paragraph 5 of this Article;

5) A list of emergency phone numbers, including the local fire department, local police department, nearest hospital, as well as phone numbers for the Engineer and Owner personnel responsible for the administration of the Work;

6) A copy of 40 CFR 761;

7) Copies of all Safety Data Sheets (SDS) pertaining to all chemicals being used during the Work;

8) A copy of this Section and the related drawings;

9) A copy of the Contractor's PCB Management Plan;

10) Copies of all daily PCB Control Area Inspection Records as defined in Paragraph 3 of this Article;

11) Copies of all weekly waste storage area inspection records as defined in Paragraph 2 of this Article;

12) A copy of the waste inventory record as defined in Article Paragraph 2 of this Article;

13) A copy of the Contractor's Hazard Communication Program as defined in Paragraph of this Article.

5. Daily Sign-In Sheets: The Contractor shall generate daily sign-in sheets for all individuals entering and exiting each PCB Control Area, for the duration of the Work. The daily sign-in sheets shall be maintained by the Competent Person and shall be made available to the Engineer or Owner for review at any time during the Work. All daily sign-in sheets shall be submitted to the Owner within 24 hours after the completion of the Work.

   a. At a minimum, each daily sign-in sheet shall include:

      1) The individual's full name (printed);

      2) The individual's signature;

      3) The name of the company the individual is representing;

      4) The time of entry and exit from each PCB Control Area;

      5) Verification by the Competent Person that the individual meets the applicable training requirements defined in Article **Error! Reference s ource not found.** of this Section, if the individual intends to enter a PCB Control Area.

6. Hazard Communication Program: The Contractor shall establish and implement a Hazard Communication Program as required by 29 CFR 1910.1200 and shall be made available to the Engineer or Owner for review at any time during the Work.

1.05 PAYMENT

A. All costs associated with the removal and disposal of suspect/confirmed PCB-containing materials and resulting wastes as shown in Table 2 attached, and other unforeseen PCB-containing materials and resulting PCB wastes that are not identified in Table 1 and Table 2 shall be reimbursed under a Hazardous Materials Allowance, as specified in Section 01 20 00 – Measurement and Payment.

B. Except for the allowance specified herein, no separate payment will be made for performing any other Work required under this Section and the Contractor shall include all costs thereof in the Lump Sum bid, as specified in Section 01 20 00 – Measurement and Payment.

C. Payment under the Lump Sum Bid for the disposal of PCB wastes will not be made until a signed copy of the manifest from the Treatment, Storage, and Disposal (TSD) facility, certifying the amount of PCB wastes delivered is returned with complete chain-of-custody documentation to the Owner.

D. The Owner will inspect the work performed, review the costs, and approve or reject requests for payment as provided by the General Conditions.

1.06 DEFINITIONS

A. Abatement: Any measures or set of measures designed to permanently eliminate PCB paint/bitumastic coating hazards. Abatement includes, but is not limited to, the removal of PCB paints/bitumastic coatings or the replacement of PCB-painted/bitumastic-coated surfaces or fixtures. Abatement also includes the removal of paints/bitumastic coatings (with a PCB concentration greater than or equal to 50 parts per million (ppm)) when the underlying substrate is to remain in place. Abatement does not include renovation, remodeling, landscaping, or other activities, when such activities are not designed to permanently eliminate PCB hazards, but instead, are designed to repair, restore, or remodel a given structure or dwelling, even though these activities may incidentally result in a reduction or elimination of PCB hazards. Furthermore, Abatement does not include interim controls (e.g., the spot removal of a PCB paint/bitumastic coating on a surface in order to perform torch cutting at that location), operations and maintenance activities, or other measures and activities designed to temporarily, but not permanently, reduce PCB hazards.

B. Area Monitoring: Stationary air sampling outside of a PCB Control Area for the purpose of determining compliance with OSHA's Limits for Air Contaminants Table (29 CFR 1910.1000, Table Z-1), and for the purpose of ensuring that airborne PCB concentrations remain below 1.0 mg/m^3 (Aroclor 1242) and 0.5 mg/m^3 (Aroclor 1254) outside of the PCB Control Area during all Work activities that have the potential to disturb PCB-Containing Materials with PCB concentrations greater than or equal to 50 parts per million (ppm). Area Monitoring for heavy metals (i.e., arsenic, cadmium, chromium, lead, or mercury) will be required if Exposure Monitoring results exceed corresponding Action Levels, Permissible Exposure Limits (PELs), or Threshold Limit Values (TLVs). If asbestos is present, Area Monitoring shall also be conducted in accordance with NYSDOL (12 NYCRR 56) regulations. All Area Monitoring shall follow pertinent NIOSH or ASTM sampling methodologies.

C. Certified Industrial Hygienist (CIH): Refers to an Industrial Hygienist employed by the Contractor who is currently certified by the American Board of Industrial Hygiene (AHIA) in comprehensive practice.

D. Competent Person: Defined by OSHA as someone who is capable of identifying existing and predictable hazards in the surroundings or working conditions, and who has authorization to take prompt corrective measures to eliminate them. Duties of the Competent Person include the following:

1. Determining prior to the performance of the Work, whether PCBs, asbestos, or other heavy metals (i.e., arsenic, cadmium, chromium, lead, or mercury) are present in the workplace;

2. Establishing PCB Control Areas and assuring that access to and from those areas is limited to authorized personnel;

3. Assuring the adequacy of any employee Exposure Monitoring required by OSHA;

4. Assuring that all employees exposed to airborne contaminant levels above Action Levels, PELs, or TLVs wear appropriate Personal Protective Equipment (PPE), respiratory protection, and are trained in the use of appropriate methods of exposure control for all of the contaminants present;

5. Assuring that proper Hygiene Facilities are provided and that workers are trained to use those facilities;

6. Assuring that engineering controls specific to the contaminants present are implemented, maintained in proper operating condition, and functioning properly.

E. Decontamination Area: Designated area within the Hygiene Facilities for removing gross contamination from PPE (using a HEPA vacuum), washing away contamination that has accumulated on the skin and hair (using soap and water), removing, and disposing/washing of contaminated PPE, and donning clean clothing that will not potentially contaminate areas outside of a PCB Control Area's Physical Boundary.

F. DOT Hazardous Materials Transportation Training: Training that meets the criteria outlined in 49 CFR 172.704. This training shall include discussions of the following:

1. Hazardous materials tables within 49 CFR 172;

2. Material packaging and labeling within 49 CFR 178;

3. Shipping papers and placards within 49 CFR 173;

4. Material loading and segregation.

G. Exclusion Zone: (See definition of “PCB Control Area”).

H. Exposure Monitoring: Personal air sampling performed outside the respirator within the breathing zone of individuals, for the purpose of determining compliance with OSHA’s Limits for Air Contaminants Table (29 CFR 1910.1000, Table Z-1). Analytical results obtained from Exposure Monitoring will be used to select appropriate respiratory protection and PPE for individuals within a work area. For the purpose of this Section, Exposure Monitoring samples shall be collected from individuals who are representative of each type of work task being conducted by the Contractor, and all Exposure Monitoring shall follow pertinent NIOSH (Method 5503) or ASTM sampling methodologies.

I. Fluorescent Light Ballast: A device that electrically controls fluorescent light fixtures and includes a capacitor containing 0.1 kilograms (kg) or less of dielectric fluid.

J. Hazardous Waste Operations (HAZWOPER) Training: Training that meets the criteria outlined in the OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120). A minimum of 24-hour HAZWOPER training will be required for Work being performed under this Section. However, certain types of Work may require 40-hour HAZWOPER Training. All decisions regarding the specific HAZWOPER Training that will be required for each Work task shall be made by the Engineer.

K. High Efficiency Particulate Air (HEPA) Filter: A filter designed to remove 99.97% of all particles greater than 0.3 micrometers (µm) in diameter. For the purpose of this Section, HEPA vacuum and local exhaust filtration equipment used by the Contractor shall meet the Standard for Safety High-Efficiency, Particulate, Air Filter Units (UL 586) developed by Underwriters Laboratories.

L. Homogenous Materials: PCB-Containing Materials which are similar in appearance, color, texture, and substrate type.

M. Hygiene Facilities: Facilities within the Physical Boundary of a work area that are set up to prevent cross contamination and are equipped with change areas and separate storage facilities for PPE and clean clothing. Hygiene Facilities shall include adequately supplied hand washing station(s) (i.e., running water, soap, and clean towels) or shower(s) (hot and cold water that is controllable at the tap, soap, shampoo, and clean towels).

N. Organic Vapor Cartridge: A respirator filter typically containing 25 to 40 grams of sorption media such as activated charcoal.

O. OSHA Monitoring: (See definition of “Exposure Monitoring”).

P. P-100 Filter: (See definition of: “High Efficiency Particulate Air (HEPA) Filter”).

Q. PCB Awareness Training: Training for individuals that have the potential to be exposed to PCB-Containing Materials or PCB Wastes. This training shall include discussions of the following:

1. Sources of PCBs;

2. Current federal, state, and local regulations pertaining to PCBs (including 40 CFR 761) and other contaminants that may be disturbed during the Work;

3. The health effects of PCBs and other contaminant exposures;

4. State-of-the-art work practices, engineering controls, and procedures for Abatement, removal, construction/demolition, materials handling, housekeeping, and waste management activities that involve PCB-Containing Materials and PCB Wastes;

5. The use and maintenance of PPE and the use and maintenance of respirators in accordance with 29 CFR 1910.134;

6. Medical surveillance programs;

7. Requirements regarding warning signs, labeling, and Safety Data Sheets (SDSs) in accordance with 29 CFR 1910.1200;

8. Responsibilities of the Competent Person.

R. PCB Bulk Product Waste: Waste derived from manufactured products containing PCBs in a non-liquid state, at any concentration where the concentration at the time of designation for disposal is greater than or equal to 50 ppm of PCBs.

S. PCB-Containing Material: Any material that contains, or is coated with, a detectable concentration of PCBs.

T. PCB Control Area: The area within the Physical Boundary where worker Hygiene Facilities are located and where all Work activities take place that involve the disturbance of PCB-Containing Materials and PCB Wastes.

U. PCB Hazardous Waste (per NYSDEC): All solid wastes containing PCB concentrations greater than or equal to 50 ppm. Refer to 6 NYCRR Part 371.4(e) for specific details and exceptions regarding the classification of PCB Wastes as “hazardous wastes” (listed waste B001-B007) in New York State.

V. PCB Waste (TSCA-regulated): Non-specific liquid or solid waste generated during the Abatement, removal, construction/demolition, handling, or cleanup of a PCB-Containing Material with a PCB concentration greater than or equal to 50 parts per million (ppm). PCB Waste also includes any waste (including remediation waste, polyethylene sheeting

and PPE) that has been in contact with a material that has a PCB concentration greater than or equal to 50 ppm, regardless of whether the waste itself has a PCB concentration of less than 50 ppm. PCB Wastes are subject to the disposal requirements set forth in Toxic Substances Control Act (TSCA) (40 CFR 761, Subpart D).

W. Perimeter Monitoring: (See definition of "Area Monitoring").

X. Permissible Exposure Limit (PEL): Defined by OSHA as individual exposure, without regard to the use of respirators, to a specific airborne concentration of a contaminant expressed in milligrams per cubic meter of air (mg/m^3) calculated as an 8-hour Time-Weighted Average (TWA). Once a PEL is met or exceeded for a particular contaminant, the Contractor is responsible for meeting specific OSHA requirements, which may include worker Exposure Monitoring, the use of PPE including respiratory protection, the use of Hygiene Facilities, medical surveillance, or training for workers. The following PELs are pertinent to disturbance, removal, construction/demolition, and disposal activities associated with PCB-Containing Materials and PCB Wastes:

1. PCB Aroclor 1254 – 0.5 mg/m^3 per 29 CFR 1910.1000, Table Z-1;

2. PCB Aroclor 1242 – 1.0 mg/m^3 per 29 CFR 1910.1000, Table Z-1.

Y. Personal Monitoring: (See definition of "Exposure Monitoring").

Z. Physical Boundary: A physical barrier designated with ropes, "caution tape," or a partition that surrounds a work area in order to limit the entry of unauthorized personnel and delineate "clean areas" from areas that may meet or exceed an Action Level, PEL, or TLV.

AA. PCBs: Any group of chlorinated isomers of biphenyl, formerly used in the form of a toxic, colorless, odorless, viscous liquid typically added to lubricants, heat-transfer fluids, and plasticizers.

BB. Regulated Area: (See definition of "PCB Control Area").

CC. Resource Conservation and Recovery Act (RCRA) Training: Training that meets the criteria outlined in 40 CFR 265.16. This training shall include site-specific discussions of the following:

1. Hazardous waste identification;

2. Waste storage container use and labeling;

3. Waste storage area management;

4. Personal health and safety, including fire safety;

5. Manifesting and the off-site transportation of wastes;

6. Procedures for using, inspecting, repairing, and replacing emergency equipment and monitoring equipment;

7. Procedures for communicating with other employees and outside emergency response personnel;

8. Responses to fires or explosions;

9. Responses to leaks, spills, and potential groundwater contamination incidents;

10. The shutdown of operations

DD. Small Capacitor: A device for accumulating and holding a charge of electricity and consisting of conducting surfaces separated by a dielectric fluid in a quantity less than 1.36 kilograms (kg) or three pounds. If the weight of the dielectric fluid is unknown, it can be assumed that a Small Capacitor is a capacitor that has a total volume of less than 1,639 cubic centimeters (cm^3) or 100 cubic inches (in^3).

EE. Threshold Limit Value (TLV): Defined by American Conference of Governmental Industrial Hygienists (ACGIH), as the concentration in air that workers could be repeatedly exposed to daily without adverse health effects.

FF. Time-Weighted Average (TWA): The average time over a given work period (e.g., an 8-hour workday) of a person's exposure to a chemical or agent. The average is determined by sampling for the chemical or agent throughout the time period.

GG. Trigger Activities: Certain activities that involve a disturbance of PCB-Containing Materials or PCB Wastes. Depending upon whether the performance of these activities exceeds an Action Level, PEL or TLV, the requirements may include additional worker Exposure Monitoring, the use of PPE including respiratory protection, the use of Hygiene Facilities, medical surveillance, or training for workers. Examples of Trigger Activities include, but are not limited to, the following: abrasive blasting, welding, torch cutting/burning, heat gun usage, needle gunning/scaling, rivet busting, using a rotopeen, mechanical sanding/grinding, using mechanical shears, hand scraping/sanding, chemical stripping, and the manual demolition of PCB-Containing Materials.

1.07 QUALITY ASSURANCE

A. Scheduling: The Contractor shall coordinate and schedule all phases of the Work to be performed under this Section with the Engineer, subcontractors, material suppliers, and other parties as necessary to ensure the proper execution of the work.

B. Compliance: In addition to the detailed requirements of this Section, the Contractor shall comply with all applicable regulations of federal, state, and local authorities pertaining to

the disturbance, abatement, removal, construction/demolition, handling, storage, transportation, and disposal of PCB-Containing Materials, and PCB Wastes. All matters regarding the interpretation of any regulations, standards, or policies shall be submitted to the Engineer for resolution before starting the Work. Where the requirements of this Section and federal, state, or local regulations conflict or vary, the most stringent requirements or regulations shall apply.

C. Rejection of Non-Complying Items: The Owner reserves the right to reject items incorporated into the Work which fail to meet the specified minimum requirements. The Owner also reserves the right to reject Contractor submittal items that are deemed inappropriate or unacceptable by the Engineer or Owner. Submittal items that may be deemed inappropriate or unacceptable include proposed vendors or subcontractors with previous regulatory citations/violations. The Owner further reserves the right, and without prejudice to other recourse, to accept non-complying items subject to an adjustment in the Contract amount, as approved by the Owner.

D. Suspect Material Characterization: To classify caulking or a paint or bitumastic coating as non-PCB containing, a paint chip/coating sample must be collected as a grab sample from the source. The sample shall be sent to an analytical laboratory meeting the requirements of this Section.

E. Suspect PCB-Containing Paints/Coatings: Although there are no certification requirements pertaining to an individual that collects paint chip samples in an industrial or commercial setting, this Section requires paint chip sampling to be performed by an individual who has successfully completed HAZWOPER Training and PCB Awareness Training courses (within the past year) as defined in this Section. In addition, the individual shall possess a current EPA Lead Inspector or EPA Risk Assessor certification or have documented experience in collecting paint chip samples.

1. Suspect ACM: All caulking and bitumastic coatings are considered suspect ACM. Therefore, if a sample will be collected, the sampling shall be performed by a certified NYSDOL Asbestos Inspector.

2. The qualifications of individuals who will collect samples must be approved by the Engineer prior to sample collection. Analytical results for samples that are collected by individuals not approved by the Engineer will not be recognized or accepted as valid by the Owner.

3. Estimate an approximate number of samples to adequately characterize painted/coated surfaces. Collect grab samples that include all layers of paint/coating from different areas randomly dispersed throughout the painted surface area. Grab samples are not to be composited.

4. PCB concentrations are based on the cumulative total of the nine (9) Aroclor cogeners (aka PCB compounds) analyzed by EPA Method SW 846-8082A (soxhlet extraction method 3540) by Gas Chromatography.

F. Qualifications:

1. Contractor: The Contractor or their proposed PCB-removal subcontractor shall have successfully completed at least two (2) projects of comparable scope and methodologies to the work being performed under this Section within the past three (3) years. This experience shall be documented by identifying the following:

   a. The name, address, and phone number of each facility where the work was performed;

   b. The name of the individual representing the owner who supervised the work at each facility;

   c. The type(s) of facilities where the work was performed;

   d. The volume and type of each material that was abated/removed;

   e. The specific method(s) of abatement and/or demolition used at each facility (including the tools, technologies, and engineering controls employed);

   f. The name of each Competent Person supervising the work on each project.

2. Competent Person: When disturbing materials and wastes with PCB concentrations greater than or equal to 50 ppm, the Contractor shall have on staff, assigned to this Contract, and on-site during all PCB-related work activities, a Competent Person, who shall:

   a. Shall have successfully completed DOT Hazardous Materials Transportation Training courses, as defined in Article 1.06F of this Section, within the past year in the form of either an initial course or a refresher course;

   b. Shall have successfully completed HAZWOPER Training courses, as defined in Article 1.06J of this Section, within the past year in the form of either an initial course or a refresher course;

   c. Shall have successfully completed PCB Awareness Training courses, as defined in Article 1.06Q of this Section, within the past year in the form of either an initial course or a refresher course;

   d. Shall have successfully completed RCRA Training courses, as defined in Article 1.06CC of this Section, within the past year in the form of either an initial course or a refresher course;

e. Shall be able to fulfill the duties defined in Article 1.06D of this Section;

f. Shall have a minimum of two (2) years' experience with work involving PCBs;

g. Shall have served as the Competent Person on at least three (3) projects of comparable scope and methodologies to the work being performed under this Section.

h. It should be noted that depending upon the specific contaminants present during the Work, additional training for the Competent Person (as described in Section 02 82 33 – Removal and Disposal of Asbestos Containing Materials) may be required.

3. PCB Waste Manager: When disturbing materials and wastes with PCB concentrations greater than or equal to 50 ppm, the Contractor shall have on staff and assigned to this Contract a PCB Waste Manager who has successfully completed DOT Hazardous Materials Transportation Training, HAZWOPER Training, PCB Awareness Training, and RCRA Training courses as defined in Article 1.06F, Article 1.06J, Article 1.06Q, and Article 1.06CC of this Section, respectively. Each training course shall have been completed within the past year in the form of either an initial course or a refresher course. In addition, the PCB Waste Manager shall have a minimum of two (2) years' experience on projects involving PCB Wastes. It is acceptable for an individual who meets the criteria of the Competent Person to also serve as the PCB Waste Manager for this Contract as long as the individual fulfills all of the requirements of this paragraph.

4. PCB Worker: When disturbing materials and wastes with PCB concentrations greater than or equal to 50 ppm, the Contractor shall have on staff and assigned to this Contract a sufficient number of PCB Workers who have successfully completed DOT Hazardous Materials Transportation Training and PCB Awareness Training courses as defined in this Section. Each training course shall have been completed within the past year in the form of either an initial course or a refresher course. In addition, each PCB Worker shall have a minimum of one (1) year of experience on projects involving PCBs and shall have worked on at least three (3) projects of comparable scope and methodologies to the work being performed under this Section. It should be noted that depending upon the specific contaminants present during the work, additional training for PCB Workers may be required.

5. Worker (low PCB concentrations): When disturbing materials and wastes with PCB concentrations less than 50 ppm, the Contractor shall have on staff and assigned to this Contract a sufficient number of workers who have successfully completed a PCB Awareness Training course as defined in this Section. Each training course shall have been completed within the past year in the form of either an initial

course or a refresher course. It should be noted that until a negative exposure assessment has been established via Exposure Monitoring, workers must wear appropriate respiratory protection.

6. Air Monitor: When disturbing any detectable concentration of PCBs, the Contractor shall have an Air Monitor assigned to this Contract who has successfully completed a PCB Awareness Training course as defined in this Section. This training course shall have been completed within the past year in the form of either an initial course or a refresher course. In addition, the Air Monitor shall have a minimum of two (2) years' experience in conducting Area Monitoring and Exposure Monitoring on projects involving PCBs. It is acceptable for an individual who meets the qualification requirements for Competent Person or PCB Waste Manager to also serve as the Air Monitor for this Contract, as long as the individual satisfies all of the requirements of this paragraph.

1.08 SPECIAL REQUIREMENTS

A. Commencement of Work: Five (5) days prior to the proposed start of work at each separate location, the Contractor shall notify the Engineer and the onsite safety staff. No work may proceed at any location until authorized by the Engineer.

B. The Contractor shall coordinate any required equipment shutdowns with the Engineer prior to starting the work.

C. Access Restrictions: The Contractor shall inform the Engineer of proposed access restrictions (i.e., areas or items of equipment which will not be accessible during the proposed Work) and give them estimated time frames (including specific dates) of such proposed access restrictions. The Contractor shall be aware that other contractors may be at any of the work Sites associated with this Contract. As a result, the Contractor shall not have exclusive rights to any work Site and shall fully cooperate and coordinate this work with the work of other contractors who may be on site. Therefore, the Contractor shall notify other contractors in advance of the disturbance, Abatement, removal, construction/demolition, and disposal Work included herein, to provide them with sufficient time for coordination of interrelated items that are included in their contracts and that must be performed before, after, or in conjunction with the Work included under this Section.

D. Unexpected Entry into a PCB Control Area: In the event that Owner personnel must enter a PCB Control Area for reasons unrelated to the supervision or inspection of Work performed under this Section (e.g., under emergency conditions), the Contractor shall immediately stop work, cleanup any loose debris and verify clearance level via air monitoring, so as to permit the safe entry by Owner personnel. Any disturbance of paints/bitumastic coatings, dusts, materials, or wastes that may potentially generate airborne concentrations of contaminants equal to or above an OSHA Action Level shall not proceed until all Owner personnel have exited from the PCB Control Area.

E. Meetings: The Contractor shall visit and investigate the site, review the Drawings, review this Section, and become familiar with any conditions which may affect the Work, as part of the pre-construction meeting and site walk-through. The Contractor shall hold all meetings with appropriate parties as scheduled and as otherwise necessary to accomplish the Work to be performed under this Section. In addition to the pre-construction meeting and site walk-through, other meetings may be required or may be requested by the Engineer, including briefings to Owner personnel. Written documentation (i.e., “minutes”) of all meetings shall be generated by the Contractor, and copies shall be provided to the Owner within three (3) business days following each meeting.

PART 2 – PRODUCTS

2.01 EQUIPMENT

A. Abrasives: Mechanical paint/bitumastic coating removal equipment shall not use any products containing crystalline silica, and the equipment shall not utilize any non-recoverable materials or any cutting materials which introduce toxic or hazardous materials into the environment.

B. Air Monitoring:

1. Exposure Monitoring: For Work involving the disturbance of any detectable concentration of PCBs, the Contractor shall collect personal air samples from employees who are anticipated to have the greatest risk of exposure, as determined by the Contractor’s Certified Industrial Hygienist or Competent Person. Personal air samples shall be collected during every work shift from at least one (1) employee that is representative of each type of work task that is being performed. Each personal air sample shall “run” for the employee’s entire work shift in order to ensure that enough volume (of air) is collected, and an accurate 8-hour TWA can be calculated. Documentation regarding the sample numbers, specific shift when the sampling was conducted, the work tasks that were sampled, the dates of sampling, the employee hours that were worked during the shift, and the total sampling times, shall accompany each laboratory chain-of-custody form.

    a. If PCB concentrations being disturbed are less than 50 ppm, Exposure Monitoring may be discontinued following a complete negative exposure assessment and approval from the Engineer and the Contractor’s Certified Industrial Hygienist. A negative exposure assessment is defined as current initial exposure monitoring using breathing zone air samples representing the 8-hour TWA exposure for each individual who are representative of each task being conducted. Following discontinuation of exposure monitoring, if there is a change to work practices, exposure monitoring shall again be

performed until a second negative exposure assessment is conducted and analyzed.

2. Area Monitoring: If PCB concentrations being disturbed are greater than or equal to 50 ppm, the Contractor shall collect a minimum of two (2) area air samples outside of each PCB Control Area on a daily basis for the duration of the Abatement, removal, or construction/demolition Work, as well as any other Work involving the disturbance of PCB-Containing Materials or PCB Wastes. During sampling activities, all air sample filter cassettes shall be positioned approximately five to six feet above the ground (in order to simulate an individual's breathing zone) and shall not be placed immediately adjacent to obstructions (e.g., walls or columns) which may restrict the flow of air to the filter cassettes. Each air sample shall be analyzed for all contaminants identified during the exposure assessment. If area Air Monitoring indicates an emission level in excess of an OSHA PEL outside of a PCB Control Area, all Work in that area shall be stopped immediately. The Contractor shall then take immediate corrective actions to reduce emission levels to below the OSHA PEL(s), and the Contractor shall clean all adjacent areas that may have become contaminated due to the emissions. Documentation regarding the sample numbers, sample locations, the dates of sampling, the employee hours that were worked during the shift, and the total sampling times, shall accompany each laboratory chain-of-custody form.

3. Documentation: Complete documentation of all Air Monitoring activities shall be in accordance with this Section.

4. The Contractor shall submit all Air Monitoring results to the Owner as soon as possible, but no later than seven (7) calendar days from when the air samples were collected.

C. Chemical Strippers: The Contractor shall utilize an environmentally safe chemical paint stripping system, with demonstrated suitability and efficiency in preparing cast-in-place concrete, cement, and plaster surfaces that are free of any visible residues of paints/bitumastic coatings. The system shall include non-alkaline or alkaline strippers that provide the lowest possible level of toxicity consistent with the types of paints/bitumastic coatings to be removed. Neutralization products and procedures shall be provided for all alkaline stripping systems, no stripping system shall contain methylene chloride, and the stripping system shall be low in volatile organic compounds (VOCs).

1. The Contractor may only use products and paint stripping systems meeting the performance sections outlined below:

   a. The Contractor shall utilize a chemical paint stripping system with a demonstrated effectiveness in maintaining PCB emissions below OSHA exposure limits during the disturbance of paints/bitumastic coatings. The

Contractor shall utilize a mechanical ventilation system during the Work that exhausts away from occupied areas. The application of all paint stripping systems shall be in accordance with manufacturer recommendations.

b. The Contractor should note that more than one (1) product may be required to strip PCB-containing paints/bitumastic coatings. The use of multiple products shall be in accordance with work practices approved by the individual manufacturer of each chemical paint stripping compound.

c. All chemical paint stripping products shall be presented to the Engineer for approval prior to the start of any Work to be performed under this Section. When presenting the products to the Engineer, they shall be in the manufacturer's unopened, original containers bearing accurate information regarding the products. Also, the manufacturer's labels on each container shall be intact and legible.

d. Chemical paint stripping systems meeting all of the requirements outlined herein, may be used pending the submittal of all required performance documentation, and its acceptance by the Engineer. Any products which do not meet all of the specifications outlined herein, shall be removed from the project site immediately, and shall not be used for the Work to be performed under this Section.

D. Protective Work Clothing and Personal Protective Equipment (PPE): The Contractor shall provide personnel who have a potential to be exposed to materials or wastes containing contaminants with appropriate PPE as prescribed by the Contractor's Certified Industrial Hygienist.

E. Respirators: Select respirators approved by the National Institute for Occupational Safety and Health (NIOSH) for use in areas where paints/bitumastic coatings, dusts, materials, or wastes containing contaminants may be disturbed. At a minimum, the Contractor shall provide each individual with a half-face, negative pressure, air purifying respirator equipped with HEPA/P-100 Filter Cartridges and Organic Vapor Cartridges until Exposure Monitoring results indicate that respiratory protection can be modified. The Contractor's Certified Industrial Hygienist shall make all determinations regarding respiratory protection modifications that will be implemented for the Work. All modifications shall be in accordance with the OSHA requirements, the Contractor's PCB Management Plan, and any relevant Asbestos Work Plan or Lead Management Plan associated with the Work.

F. Waste Containers: Containers for the storage of all PCB Wastes shall be DOT-approved and shall be provided by the Contractor.

PART 3 – EXECUTION

3.01 PROCESS AND PROCEDURES

A. Protection of Existing Work to Remain: All Work involving the disturbance of PCB-Containing Materials and PCB Wastes must be conducted without damage to, or contamination of equipment or surfaces within the work areas or other areas adjacent to the work areas. All such damage or contamination shall be immediately corrected and cleaned up by the Contractor at the Contractor's expense.

B. Physical Boundary Delineation: The Contractor shall clearly delineate each work area and waste storage area with a physical boundary in accordance with Article 1.06Z of this Section.

C. Signs: The Contractor shall post conspicuous warning signs at all approaches to work areas and waste storage areas. The signs shall be located at such a distance so that personnel may read the sign and take necessary precautions before entering a work area or waste storage area. Signs shall comply with federal, state, and local regulations, including the requirements of the OSHA. At a minimum, each sign shall bear the following information in English and the predominant language that is spoken by the Contractor's employees if English is not spoken:

WARNING
PCB WORK AREA
POISON
NO SMOKING OR EATING

1. Each sign shall be appropriately modified to include additional warnings for other contaminants that are identified during Exposure Monitoring.

D. Hygiene Facilities: The Contractor shall provide functional Hygiene Facilities in accordance with Article 1.06L of this Section, that are appropriate for the type(s) of Work being performed under this Section. The Contractor shall ensure that employees do not leave a PCB Control Area wearing any potentially contaminated PPE. Using compressed air to dislodge dust from work clothing/PPE shall be strictly prohibited. The Contractor shall collect, test, and properly dispose of all wastewater generated from Hygiene Facilities.

1. Handwash Stations: The Contractor shall provide functioning handwash stations on all projects that disturb PCB-Containing Materials with concentrations equal to or greater than 50 ppm, or PCB Wastes. Handwash stations shall have running water at the tap, clean towels, and soap per 29 CFR 1926.51. Substituting "hand wipes" in place of soap and running water will not be acceptable.

2. Showers: The Contractor shall provide shower facilities for use by employees whose airborne exposure to PCBs is above an OSHA Permissible Exposure Limit (PEL). When shower facilities are necessary, employees are required to shower at the end of the work shift each day prior to leaving the PCB Control Area they are working in.

E. Utilities: The temporary use of any on-site utilities shall be subject to the approval of the Owner. The Contractor shall furnish all water and hoses needed for the Work, as well as any temporary hookups. The Contractor shall supply any necessary heating equipment and water filtration devices necessary for the Work. In addition, all temporary lighting and temporary electrical service to a PCB Control Area shall be provided by the Contractor and shall be in weather-proof enclosures and be ground fault protected.

F. Work Area Preparation: The Contractor shall utilize HEPA-filtered vacuums, and wet methods during the initial cleaning of each work area. Prior to removal from each work area, all movable objects and mounted objects that can be removed shall be pre-cleaned using HEPA-vacuums and wet methods. Fixed objects that must remain within each work area shall be pre-cleaned using HEPA vacuums and wet methods, and subsequently covered with 6-mil polyethylene sheeting.

G. Air Monitoring: Air monitoring for airborne concentrations of lead and other toxic metals to be determined by the Engineer (e.g., cadmium during demolition of cadmium-quenched bolts and pipe hangars) shall be conducted by the Air Sampling Technician in accordance with OSHA and Articles 1.06B and Article 1.06H of this Section.

1. Exposure Monitoring: For Work involving the disturbance of any detectable concentration of Lead or other heavy metals, the Contractor shall collect personal air samples from employees who are anticipated to have the greatest risk of exposure, as determined by the CIH or Competent Person. Personal air samples shall be collected during every work shift from at least one (1) employee that is representative of each type of work task that is being performed. Each personal air sample will “run” for the employee’s entire work shift in order to ensure that enough volume (of air) is collected, and an accurate 8-hour TWA can be calculated. Documentation regarding the sample numbers, specific shift when the sampling was conducted, the work task(s) that were sampled, the date(s) of sampling, the employee hours that were worked during the shift, and the total sampling time(s), shall accompany each laboratory chain-of-custody form.

2. Area Monitoring: The Contractor shall collect a minimum of two (2) area air samples outside of each lead control area on a daily basis for the duration of the lead abatement work and any work involving the disturbance (e.g., demolition) of lead paints/coatings, lead dusts, lead-containing materials, or lead wastes. During sampling activities, all air sample filter cassettes shall be positioned approximately five to six feet above the ground (in order to simulate an individual’s breathing zone) and shall not be placed immediately adjacent to obstructions (e.g., walls or

columns) which may restrict the flow of air to the filter cassette. If area air monitoring indicates an emission level in excess of 30 µg/m3 of air outside a lead control area, all lead work in that area shall be stopped immediately. The Contractor shall then take immediate corrective action to reduce emission levels to below 30 µg/m3 of air, and the Contractor shall clean all adjacent areas that may have become contaminated due to the emission. If lead abatement work or work involving the disturbance (e.g., demolition) of lead paints/coatings, lead dusts, lead-containing materials, or lead wastes is performed outside of a building/structure, or if dusts generated from the work are exhausted outside of the building/structure where the work is taking place, additional area monitoring must be performed to ensure compliance with NYSDEC ambient air quality standards. Documentation regarding the sample numbers, sample locations, the date of sampling, the employee hours that were worked during the shift, and the total sampling times, shall accompany each laboratory chain-of-custody form.

3. Documentation: Complete documentation of all air sampling activities shall be in accordance with Article **Error! Reference source not found.** of this Section.

4. The Contractor shall submit all air monitoring results to the Owner within 24 hours from when the air samples were collected.

H. Chemical Strippers: Chemical Strippers: Acceptance of the Work shall be contingent upon inspection of the abated substrate surfaces by the Engineer and must demonstrate the absence of residual paint/bitumastic coating layers that can be physically measured, pried loose, or peeled away using a scraping device. The Contractor may only use products and paint stripping systems meeting the performance requirements as defined in Article of this Section.

I. Mechanical Removal Equipment: The use of mechanical equipment to remove asbestos-containing caulking or bitumastic coatings will require compliance with NYSDOL (12 NYCRR 56) asbestos regulations, including the use of a full containment enclosure under negative air pressure.

1. When removing paints/bitumastic coatings from metal surfaces, the paints/bitumastic coatings must be removed to the extent that only the bare metal remains (i.e., no mill scale remains). In the case of substrates other than metal (e.g., concrete, brick, and block), paints/bitumastic coatings shall be removed from the surface of the substrate to the extent that flaking and peeling will not occur subsequent to the performance of the Work. Acceptance of the Work shall be contingent upon inspection of the substrate surfaces by the Engineer and must demonstrate the absence of residual paint/coating layers that can be physically measured, pried loose, or peeled away using a scraping device. The Contractor may only use products and tools meeting the performance specifications outlined below:

a. The Contractor shall utilize a vacuum-assisted power tool system with demonstrated suitability and efficiency in preparing metal surfaces to the SSPC SP-11 standard, and with demonstrated effectiveness in maintaining PCB emissions below OSHA exposure limits during the disturbance of paints/bitumastic coatings. Such systems may include dustless needle guns, dustless rotopeens, and dustless right-angle grinders, all of which capture dust and debris at the cutting tool edge and transport the material under vacuum conditions to an air-tight disposal container. Dustless needle guns shall only be utilized on metal surfaces.

b. The vacuum-assisted power tool system shall also be designed to permit the removal and replacement of collection containers under negative pressure in order to prevent the release of dusts. The system shall be equipped with an automatic “shut-off” in the event of vacuum failure.

c. Abrasive/recovery tools shall be monitored at all times by a device capable of determining recovery at the face of each tool, and capable of automatically disabling the tool in the event that recovery levels are insufficient. The monitor, at a minimum, shall have the following features:

    1) A remote warning light;

    2) An adjustable recovery set point;

    3) Automatic equipment disabling capabilities;

    4) A sensing range of 0 5 pounds per square inch (psi);

    5) Solid state photohelic instrumentation;

    6) Remote sensing at the face of the tool.

d. The safe recovery point shall be calibrated each day before start-up, or each time a new tool or vacuum source is used. All manufacturer recommendations shall be followed with respect to the set up and use of the monitor, and the manufacturer's operations manual shall be kept on site at all times. A daily log shall be maintained by the Contractor, identifying all calibrations of recovery levels, as well as any “down time” as a result of insufficient recovery levels.

e. The cutting head of the vacuum-assisted power tool system that is used on flat surfaces shall be capable of cutting to within 1-1/2" of any inside corner, molding, or edge, and may include dustless rotopeens or dustless needle guns. Tools for corners and moldings shall be specifically designed for that purpose, and conform to all inside corners, outside corners, curved, flat, and angled surfaces that are to be abated under this Section. These tools shall

also maintain vacuum control at the Work surface/cutting head interface at all times. HEPA vacuum-shrouded needle guns may be used for non-flat surfaces in accordance with manufacturer recommendations. Vacuum-assisted finishing tools, such as right-angle grinders, may be used to achieve the SSPC SP 11 standard, but may not be used for primary removal.

f. Vacuum-assisted power tool systems meeting all of the specifications outlined herein, may be used pending the submittal of all required performance documentation, and their acceptance by the Engineer. Any tools which do not meet all of the specifications outlined herein, shall be removed from the project site immediately, and shall not be used for the Work to be performed under this Section.

J. Prohibited Activities: Contractors shall not conduct activities that are prohibited by OSHA and EPA regulations. The following activities are prohibited, regardless of whether they are conducted subject to an exposure assessment and written compliance program:

1. Burning-off paints/bitumastic coatings;

2. Using heat guns operating above 1100^{o} F;

3. Dry machine sanding, grinding, or blasting paint without a HEPA vacuum exhaust tool;

4. Uncontained hydroblasting or high-pressure washing;

5. Welding painted/coated surfaces unless the paint/coating is removed at least 4-inches from area of heat application (per 29 CFR 1926.345(c)(1)), and local exhaust ventilation is used.

K. Test Patches: Prior to choosing the paint removal method(s) for paints/bitumastic coatings, the Contractor shall perform test patches on surfaces subject to Abatement or spot removal, to determine if the method(s) meet the requirements of this Section.

3.02 CLEANUP AND DISPOSAL

A. Cleanup: The Contractor shall maintain all surfaces, including protective coverings (polyethylene sheeting) within each work area, free of accumulations of paint chips/coating debris, dusts, and wastes. The Contractor shall perform housekeeping activities daily throughout each work shift and at the end of each work shift, in order to prevent any accumulation of paint chips/coating debris, dusts, and wastes in the work areas. Dry sweeping and using compressed air to cleanup a work area shall be strictly prohibited. HEPA-filtered vacuums and wet methods shall be used to ensure that each work area remains free of visible paint chips/coating debris, dusts, and wastes. Perform Work in accordance with SSPC Guide 6.

B. Collection, Separation, and Containerization of Wastes: The Contractor shall collect, separate (by waste stream/waste type), and containerize PCB containing wastes (solid and liquid), debris, PPE, and containment materials on a daily basis in accordance with the PCB Safe Work Practices or PCB Management Plan.

1. If any source sample from a specific work area indicates that PCBs in paints/coatings are greater than or equal to 50 ppm, then all waste from that area will be characterized as TSCA-regulated waste. All waste streams must be segregated into separate drums and labeled with PCB waste labels, including out of service date (when PCB waste is first place in the drum) in addition to RCRA hazardous waste labels (pending analysis). This may include one or more drums for paint chips, chemical stripper waste, and HEPA filters associated with HEPA vacuums. Other waste such as PPE, rags and polyethylene sheeting from a specific work area may be comingled in drums separate from the drums containing paint chips, stripper waste and HEPA filters.

2. If all source samples from a specific work area indicate that PCBs in paints/coatings are less than 50 ppm, then all PPE, poly and paint/coating waste from that area will be characterized as PCB-containing non-hazardous or hazardous waste pending TCLP analysis of the eight (8) RCRA metals in the waste stream and should not be managed as C&D debris. Drums should be labeled with RCRA hazardous waste labels (pending analysis). All waste streams shall be segregated into separate drums. Paint chips and HEPA filters shall be drummed as one waste stream from each work area, and polyethylene sheeting, rags, paper towels and PPE from each work area will be drummed as a separate waste stream.

3. The Contractor shall store all wastes in DOT-approved container systems. No drum/container shall be filled in excess of the capacity marked on the drum/container. All drums/containers shall be sealed and covered immediately after filling, and each drum/container shall have a label affixed to it in accordance with the requirements of this Section. All labels shall remain intact and legible at all times.

4. No water mixed with or contaminated by hazardous waste may be released onto the ground or into any drain or sewer. It should be noted that a discharge of more than 1 lb. of PCBs onto the ground or into the water within a 24-hour period, shall be considered a violation of the Clean Water Act and shall be treated as a “reportable quantity” in accordance with 40 CFR 116, 40 CFR 117, and 40 CFR 302. Such a release shall be grounds for immediate termination of this Contract, and the Contractor shall be liable for any fines, penalties, or remediation costs.

5. The Contractor shall store non-hazardous wastes separately from hazardous wastes and TSCA-regulated wastes, shall provide all non-hazardous waste containers, and shall make all transportation and disposal arrangements for non-

hazardous wastes in accordance with federal, state, and local regulations. TSCA-regulated PCB waste must be disposed within 180 days subject to the requirements of 40 CFR 761.65, in addition to any RCRA hazardous waste storage requirements (i.e., 90 days), as applicable.

C. Storage of Wastes: The Contractor shall ensure that all drummed wastes are stored in a secondary containment system, and that each waste storage area is demarcated with a Physical Boundary. In addition, the Contractor shall post weekly waste inspections and waste inventories in the regulated waste storage area, as required in this Section:

1. The name and telephone number of the facility's Emergency Coordinator;

2. The location of fire extinguishers and fire alarms;

3. The location of spill control materials;

4. The telephone number for the fire department (unless the facility has a direct alarm).

D. Labeling: The Contractor shall affix warning labels to all PCB Waste and hazardous waste drums/containers. Labels must be filled out completely at the point of generation when waste is first

CAUTION
CONTAINS PCBs
A toxic environmental contaminant requiring
special handling and disposal in accordance with
U.S. Environmental Protection Agency Regulations
40 CFR 761 – For Disposal Information contact
the nearest U.S. EPA Office
[Out-of-Service Date – when PCB waste is first placed in drum]

HAZARDOUS WASTE
FEDERAL LAW PROHIBITS IMPROPER DISPOSAL

HANDLE WITH CARE
[Generator Name, Address, and Telephone Number]
[Specific Contents of Container]
[EPA-Issued Generator Identification Number]
[EPA Waste Identification Number]
[Accumulation Start Date]
[Accumulation End Date]
(If waste classification is pending analysis for RCRA/NYSDEC hazardous waste, the RCRA hazardous waste labels shall indicate "PCB/Hazardous Waste - Pending Analysis.")

containerized. Labels shall comply with the requirements of federal, state, and local regulations. PCB labels shall be used to designate PCB waste, including out-of-service date, in addition to RCRA hazardous waste labels. At a minimum, all PCB and hazardous waste labels shall bear the following information in English:

E. Equipment Decontamination: All reusable equipment (e.g., hand tools and power tools) that has been in contact with materials that have a PCB concentration greater than or equal to 50 ppm and PCB Wastes, shall be thoroughly decontaminated prior to being removed from the PCB Control Area in accordance with 40 CFR 761.79(c)(2)(i), which permits “swabbing surfaces that have contacted PCBs with a solvent.” The solvent shall be a PODF as defined in 40 CFR 761.79(c)(3)(iv)(C) or (D). Used decontamination materials (e.g., rags used to swab equipment) shall be collected, stored, and disposed of in accordance with this Article.

F. Characterization and Disposal of Wastes:

1. Sampling and Laboratory Analysis of PCB-Containing Wastes: For PCB Waste characterization, the PCB Waste Manager shall sample all potential PCB-containing waste streams in accordance with the TSCA (40 CFR 761). According to the EPA, characterizing PCB-containing waste streams (i.e., determining whether wastes are regulated or non-regulated under TSCA) shall be made based upon the total PCB concentration at the “source” (e.g., the paint/bitumastic coating) prior to any disturbance that may be initiated through Abatement, removal, or construction/demolition activities. Unlike hazardous waste determinations that are made under RCRA (40 CFR 260 and 40 CFR 261), sampling to determine whether a waste is TSCA-regulated shall not be made based on the sampling and analysis of mixed bulk waste materials/debris generated as a result of Abatement, removal, or construction/demolition activities. Instead, source materials for PCBs must be collected as grab samples and must not be composited during collection or analysis as that may reduce the concentration of PCBs detected. Rather, individual source samples shall be submitted for analysis to determine the highest concentration of PCBs contained in the source material or wastes.

    a. PCB concentrations are based on the cumulative total of the nine (9) Aroclor congeners (aka PCB compounds) analyzed by EPA Methods SW 846-8082A (soxhlet extraction method 3540) by Gas Chromotography.

    b. If PCB concentrations in paints/coatings are present greater than or equal to 50 ppm, all PCB-containing waste generated during paints/coatings disturbance will be classified as TSCA-regulated PCB waste. If PCB concentrations in paints/coatings are less than 50 ppm, all PCB-containing waste generated in the area will be classified as non-TSCA PCB-containing waste.

c. If it cannot be confirmed that the source of drummed waste (e.g., paints/coatings) is non-TSCA-regulated, or no source samples are available, or the soxhlet extraction method 3540 was not used for previous analyses, then four (4) biased worse-case grab samples shall be collected from the drum and each sample analyzed for Total PCBs. If any one grab sample result has a PCB concentration of equal to or greater than 50 ppm, the drummed waste shall be characterized as TSCA-regulated waste.

d. Waste materials/debris generated during Abatement, removal, or construction/demolition activities may be classified as RCRA or NYSDEC hazardous waste (6 NYCRR Part 370 and 6 NYCRR Part 371.4(e)) in addition to being TSCA-regulated. Therefore, wastes/debris must still be sampled and characterized prior to disposal. All waste samples shall be collected in the presence of the Engineer using the following procedure:

1) Sampling of drummed waste will be biased for the worst-case (highest result) and will be based on inspection of drum contents. For drums with paint chips, with or without stripper waste, collect one grab sample for every quarter of the drum, from any hot spots (i.e., paint chips). As an example, if the drum is full, collect four grab samples, if the drum is half-full, collect two grab samples, and if the drum is one-tenth full, collect one sample. Grab samples shall be composited into one (1) bulk composite sample. For drums with PPE, polyethylene sheeting, rags, and towels, collect up to four (4) grab samples with positive bias for paint chips or paint-related staining. As such, samples are likely to be collected from dust or chips at the bottom of the drum. Each grab sample shall be composited into one (1) bulk composite sample, labeled, and submitted to a laboratory that satisfies the requirements set for in this Section. Composite samples shall undergo Toxicity Characteristic Leaching Procedure (TCLP) analysis for the eight (8) RCRA metals and Total PCBs to determine if waste is a NYSDEC hazardous waste (i.e., listed waste B007).

2) The Contractor shall also direct the laboratory to analyze each sample for any additional parameters that are required by the specific TSDF being used. Furthermore, if the waste stream is associated with the use of a chemical paint stripping system, the Contractor shall have the laboratory analyze each sample for pH and any other RCRA characteristic that may fail due to the chemical composition of the waste. The Contractor shall ensure that the laboratory being used to satisfy the requirements of this Section is also capable of performing these additional analytical tests.

3) One (1) representative wastewater sample shall be collected for laboratory analysis from each drum generated. Each sample shall be

collected using appropriate field sampling equipment (e.g., a pipette or bailer), and shall be labeled and submitted to a laboratory that satisfies the requirements of this Section.

2. Sampling and Laboratory Analysis of PCB-Containing Demolition Debris: The Contractor shall collect representative bulk samples of anticipated demolition wastes to determine proper disposal. In addition to a total PCB analysis of the source materials (e.g., paints/bitumastic coatings), representative bulk samples shall be collected from painted/bitumastic-coated building materials for TCLP analysis for the eight (8) RCRA metals and Total PCBs to determine if waste is a NYSDEC listed hazardous waste (i.e., listed waste B007).

   a. Scrap Metal Exemption for Recycling: Under 6 NYCRR Part 371.1(c)(7), painted scrap metal can be sent to a recycling facility, rather than be discarded as hazardous waste. In order for the DEF to submit a “c7 notification” to the NYSDEC and claim the “scrap metal exemption,” the Contractor must first submit notification to their recycling facility indicating that PCBs are present on the scrap metal in concentrations less than 50 ppm. If concentrations are greater than or equal to 50 ppm, the scrap metal cannot be recycled and instead must be disposed of as a TSCA-regulated waste. If Lead or other heavy metals are detected in the paints/bitumastic coatings on the scrap metal, the Contractor shall also disclose this information to the recycling facility. The Contractor shall receive written permission from the recycling facility indicating that the facility will accept the PCB paint/bitumastic coated scrap metal generated during the Work to be performed under this Section. The Contractor shall submit this documentation to the Engineer for approval prior to disposal.

   b. Bulk demolition debris (e.g., painted concrete) that is sampled and determined to be non-RCRA-regulated and non-TSCA-regulated waste may be disposed of as construction and demolition (C&D) debris as per Section 01 74 20 – Construction Waste Management and Section 02 41 10 – Demolition and Removals.

3. Disposal of Wastes: All waste profiles for containerized wastes must be reviewed by the Engineer and signed by the Owner as the generator of the waste streams. The Contractor shall notify the Owner at least 14 business days prior to the removal of any waste drums/containers, so that the Owner can inspect the drums/containers and the waste manifests. As per 40 CFR Part 761.207, a Uniform Hazardous Waste Manifest shall be completed for TSCA-regulated and/or NYSDEC hazardous wastes. Wastes shall be disposed of to ensure that drums/containers do not remain on the job site for more than 90 calendar days from the initial “accumulation start date” on the label affixed to the drum/container. Containers that have reached their storage capacity shall not remain on site, and transportation arrangements shall be made for their immediate removal.

a. Small Capacitors and Fluorescent Light Ballasts: Small Capacitors and Fluorescent Light Ballasts are not classified as hazardous wastes under NYSDEC regulations (6 NYCRR 371.3(e)). However, these items are assumed to contain PCBs, and therefore must be disposed of as PCB Bulk Product Wastes unless marked “No PCBs” by the manufacturer. Small Capacitors and Fluorescent Light Ballasts that are not marked “No PCBs” or are leaking (regardless of PCB concentration), must be managed at one of the following facilities in accordance with 40 CFR 761.62(a):

1) In facilities using a TSCA-approved incinerator;

2) At a TSCA/RCRA-permitted landfill;

3) In facilities using an approved alternate method of destroying PCBs;

4) At a facility using an approved method of removing/decontaminating PCBs;

5) Using a TSCA PCB Coordinated Approval issued by the EPA Regional Administrator.

G. Disposal Documentation: The Contractor shall submit written evidence that the TSDF receiving PCB Wastes is approved by federal, state, and local regulatory agencies to receive TSCA-regulated wastes. If asbestos or heavy metals (as defined in Section 02 82 33 – Removal and Disposal of Asbestos Containing Materials and Section 02 83 33 – Removal and Disposal of Lead Containing Materials) were detected in the wastes, the Contractor shall also ensure that the TSDF is approved by federal, state, and local regulatory agencies to receive these wastes. Once all waste profiles have been completed, the Contractor shall provide the Owner a “Letter of Approval” issued from the TSDF indicating that the wastes will be accepted. The Contractor shall submit to the Owner one (1) copy of the completed manifest that has been signed and dated by the initial transporter and TSDF in accordance with 6 NYCRR 372, 6 NYCRR 373, 40 CFR 262, 40 CFR 263 and 40 CFR 264. All waste profiles, manifests, and Land Disposal Restrictions (LDRs) must be signed by Owner personnel as per 40 CFR 268 and 6 NYCRR 376, and as described in Section 01 35 45 - Hazardous Materials Control.

END OF SECTION

TABLE 1: SUMMARY OF PCB ANALYSIS ON MISCELLANEOUS MATERIALS

Sample ID	*Location*	*Sample Description*	*Material*	*Color*	*Result (mg/kg)*
RCSD-PCB-01	Exterior	Around door frame	Caulk	Brown	ND
RCSD-PCB-02	Exterior	Around vent	Caulk	White	ND
RCSD-PCB-03	Screen Chamber	Screen conveyor and actuator	Grease	Black	ND

Notes:
(1) Samples collected at the Mechanical Screen Building by Bidwell Environmental in May 2023.
(2) The regulatory limit for defining TSCA-regulated PCBs is 50 mg/kg.
(3) Sample results noted above are considered representative of materials with similar age, appearance, and texture within the same general area.
(4) Contractor to verify the locations and extent of each material.
ND- Not detected

TABLE 2: INACCESSIBLE SUSPECT MATERIALS REQUIRING FURTHER INVESTIGATION

Material Description	*Location*	*Quantity*	*Comments*
Below grade	Mechanical Screen Building, Screen Chamber	Unknown	The subgrade was not accessible during the hazards assessment. A hazards assessment for PCBs s and other misc. hazardous materials should be performed prior to work in the subgrade.

SECTION 02 85 10

REMOVAL AND DISPOSAL OF MERCURY

PART 1 – GENERAL

1.01 SUMMARY

A. This Section details the requirements for construction and demolition activities affecting materials containing mercury as identified in Table 1 included at the end of this Section, or required to complete the Work, including all mercury and mercury-containing equipment identified and impacted by the Work:

B. All Work to be performed under this Section shall be performed using methods that have demonstrated effectiveness in minimizing the quantity of hazardous waste generated; protecting the health and welfare of all site personnel and the public; and avoid adverse environmental impacts.

C. The Contractor shall perform the removal and recycling/disposal of additional materials containing mercury not shown on the Contract Drawings (i.e., unforeseen conditions). These removal and recycling/disposal activities shall be performed in accordance with this Section and applicable federal, state, and local regulations.

D. All mercury-containing wastes generated during this Contract Work that qualify as Universal Wastes under federal, state, or local regulations, must be recycled (and not disposed of as hazardous wastes) regardless of the quantity of wastes generated.

E. The Contractor shall conduct work in accordance with the General Contract Conditions and Special Contract Conditions.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 20 00 – Measurement and Payment

B. Section 01 35 45 – Hazardous Materials Control

C. Section 01 73 00 – Demolition and Execution of Work

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. The Contractor shall comply with all applicable regulations, standards, and guidelines of federal, state, and local environmental and occupational safety and health agencies regarding Mercury-Containing Materials and Mercury wastes. These regulations, standards, and guidelines include, but are not limited to the following:

1. United States (U.S.) Department of Transportation (DOT):

a. 49 CFR 171 – General Information, Regulations, and Definitions

b. 49 CFR 172 – Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements

c. 49 CFR 173 – Shippers: General Requirements for Shipments and Packaging's

d. 49 CFR 178 – Specifications for Packaging's

2. United States Environmental Protection Agency (EPA):

a. 40 CFR 116 – Designation of Hazardous Substances

b. 40 CFR 117 – Determination of Reportable Quantities for Hazardous Substances

c. 40 CFR 260 – Hazardous Waste Management Systems: General

d. 40 CFR 261 – Identification and Listing of Hazardous Waste

e. 40 CFR 262 – Standards Applicable to Generators of Hazardous Waste

f. 40 CFR 263 – Standards Applicable to Transporters of Hazardous Waste

g. 40 CFR 264 – Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

h. 40 CFR 265 – Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

i. 40 CFR 268 – Land Disposal Restrictions

j. 40 CFR 273 – Standards for Universal Waste Management

k. 40 CFR 302 – Designation, Reportable Quantities, and Notification

3. New York State Department of Environmental Conservation (NYSDEC):

a. 6 NYCRR 364 - Waste Transporter Permits

b. 6 NYCRR 370 – Hazardous Waste Management Regulations

c. 6 NYCRR 371 – Identification and Listing of Hazardous Waste

d. 6 NYCRR 372 – Hazardous Waste Manifest System and Related Standards for Generators, Transporters, and Facilities

e. 6 NYCRR 373 – Hazardous Waste Management Facilities

f. 6 NYCRR 376 – Land Disposal Restrictions

4. Chapter 145, Laws of New York, 2004 – Mercury-Added Consumer Products Law

5. National Institute for Occupational Safety and Health (NIOSH):

a. NIOSH Pocket Guide to Chemical Hazards

6. Occupational Safety and Health Administration (OSHA):

a. 29 CFR 1910 – Occupational Safety and Health Standards for General Industry

b. 29 CFR 1910.28 – Safety Requirements for Scaffolding

c. 29 CFR 1910.1200 – Hazard Communication Standard

d. 29 CFR 1926 – Safety and Health Regulations for Construction

e. 29 CFR 1926 Subpart T – Demolition

f. 29 CFR 1926.1153 – Respirable Crystalline Silica

7. Underwriters Laboratories, Inc. (UL):

a. UL 586 – Standard for Safety High Efficiency, Particulate, Air Filter Units.

1.04 SUBMITTALS

A. Within 30 business days of the “Notice to Proceed”, or as directed by the Engineer, the Contractor shall submit the following to the Engineer:

1. Mercury Management Plan: The Contractor shall submit a detailed, project-specific Mercury Management Plan that addresses work procedures and equipment to be used during the disturbance, removal, construction/demolition, handling, collection, and disposal of Mercury-Containing Materials and Mercury Wastes. The Mercury Management Plan shall be prepared in accordance with this Section and all pertinent federal, state, and local regulations, and shall be coordinated with the Engineer. The Mercury Management Plan shall be signed and dated by a Certified Industrial Hygienist meeting the qualifications set forth in Article 1.06B of this Section. The Mercury Management Plan shall include the following elements:

a. Drawings showing the locations and details of each work area and each waste storage;

b. A detailed discussion regarding the interfacing of trades (i.e., how the Contractor will coordinate the Work with other contractors or Owner employees working at the site) and the sequencing of mercury-related Work;

c. A detailed discussion on the implementation of proper precaution when Mercury containing equipment (gauges, switches, flow meters, manometers, thermometers, flow regulators, laboratory equipment, lamps, etc.) is removed to prevent release of elemental mercury onto or into connected equipment or appurtenances;

d. A detailed discussion on the implementation of proper precaution when Work involves removal, repair or alterations of equipment or appurtenances where known or suspected historical mercury containing equipment (gauges, switches, flow meters, manometers, thermometers, flow regulators, laboratory equipment, lamps, etc.) may have been part of the system;

e. A detailed discussion regarding the collection, handling procedures, and recycling/disposal of Mercury-Containing Materials and Mercury Wastes;

f. A detailed discussion regarding “real-time” air monitoring for mercury vapor (e.g., using a Jerome® meter) to be implemented during the Work, as applicable. Indicate what Action Levels will be used for the Work, how compliance with the Action Levels and the REL will be determined, and who will be responsible for ensuring that compliance with the Action Levels and REL is maintained. At a minimum, Action Levels shall be established for the following situations:

    1) The removal of broken/leaking Mercury-Containing Materials;

    2) The implementation of engineering controls and safe work practices;

    3) Upgrades/downgrades in levels of PPE;

    4) Work stoppage or the emergency evacuation of on-site personnel;

g. A detailed discussion regarding housekeeping procedures to be used for maintaining clean work areas;

h. A detailed task analysis for each Work activity that has the potential to disturb Mercury-Containing Materials or Mercury Wastes. Each task analysis shall include, but is not limited to, the following information:

    1) The type of Work activity;

    2) The tools/equipment that will be used;

3) Operation and maintenance practices and procedures that will be used for the tools/equipment;

4) The types of Mercury-Containing Materials that may be disturbed, or Mercury Wastes that may be generated when performing the activity;

5) The engineering controls that will be used to control the spread of contamination during the activity;

6) The proposed crew size for the activity and individual employee responsibilities during the activity;

7) Housekeeping procedures that will be used during the activity;

8) PPE that will be used for the removal of both intact and broken (leaking) Mercury-Containing Materials, and the decontamination protocol when handling removal of broken (leaking) mercury-containing equipment;

i. Equipment and Supplies: Identify the equipment and supplies that will be used to perform the Work;

j. Rental Equipment Notification: If rental equipment is to be used during the Work, the Contractor shall notify the rental agency in writing concerning the intended use of the equipment.

k. Safety Data Sheets (SDSs): Provide SDSs for all chemical products to be used for the Work;

l. Training and Experience: For all activities that disturb Mercury-Containing Materials and Mercury Wastes, the Contractor shall submit for this Contract a sufficient number of properly trained and experienced workers, each of whom shall:

1) Have written proof of training (e.g., certificates) in accordance with the qualification requirements for Competent Persons and Mercury Workers that will be used for the Work, set forth in Article 1.07D.2 and Article 1.07D.3 of this Section;

2) Copies of resumes for Competent Persons and Mercury Workers that will be used for the Work, indicating work experience as required in Article 1.07D.2 and Article 1.07D.3 of this Section;.

m. The name and qualifications (i.e., experience and training documentation) of the Competent Person who will be responsible for the oversight and execution of the Mercury Management Plan during activities affecting

Mercury-Containing Materials and Mercury Wastes. At a minimum, the Competent Person shall satisfy the qualification requirements set forth in Article 1.07D.2 of this Section;

n. A detailed schedule for the implementation of the Mercury Management Plan elements. The schedule shall clearly indicate the starting and completion dates for the work and shall allow adequate time for cleanup activities and inspections.

o. A current (i.e., within the last month) signed and notarized statement disclosing all of the Mercury Removal Company's OSHA, EPA, and DOT citations/violations within the past three (3) years.

2. Waste Management Plan: The execution of the Waste Management Plan must be coordinated with the Owner Personnel. The Waste Management Plan shall comply with all applicable federal, state, and local waste regulations, and address the following:

a. The identification of Mercury-Containing Materials and Mercury Wastes (as defined in 40 CFR 116, 40 CFR 260, 40 CFR 261, 6 NYCRR 370, and 6 NYCRR 371) associated with the Work;

b. The estimated quantity of each waste stream that will be generated and recycled/disposed of as per 40 CFR 302;

c. The names, addresses, phone numbers, and qualifications of each vendor and facility that will be transporting, storing, testing, and/or recycling/disposing of the wastes. The Contractor shall verify the permit status of the facility as well as check for outstanding violations and enforcement actions. Include a 24-hour phone contact for each vendor/facility.

d. Current permit documentation for each recycling facility/TSDF indicating that the facility is approved by federal (40 CFR 264 and 40 CFR 265), state (6 NYCRR 373), and local regulatory agencies to receive Mercury-Containing Materials and Mercury Wastes. The documentation shall include an "acceptance letter" from each recycling facility/TSDF indicating its ability to accept the specific waste streams that will be generated during Work performed under this Section;

e. Current 6 NYCRR 364 and 40 CFR 263 permit documentation for the waste transporter that will transport Mercury-Containing Materials and Mercury Wastes from the work Site to the recycling facility/TSDF. The documentation shall clearly indicate the transporter's ability to deliver the Mercury-

Containing Materials and Mercury Wastes to the chosen recycling facility/TSDF;

f. Spill prevention, containment, and cleanup contingency measures to be implemented during the Work, as well as procedures to be followed during a suspected mercury emissions/bulk material release or emergency situation. All measures and procedures shall be in accordance with this Section;

g. A detailed discussion of the on-site handling, storage, removal, and recycling/disposal of waste materials. This discussion shall include, but is not limited to, the following:

1) Specifications for a secondary containment system for each drum storage area;

2) The methods of demarcation that will be used to identify the waste storage areas and each waste container;

3) The methods and procedures that will be used to collect and containerize wastes on a daily basis;

4) The types of containers that will be used to containerize the wastes;

5) The posting of weekly regulated waste inspection and inventory records as required in this Section.

B. Field Reports and Recordkeeping: During all Work performed under this Section, the Contractor shall maintain and provide the following documentation:

1. Recycled Materials/Waste Documentation:

a. Waste Manifests: Completed and signed waste manifests from recycling facilities/Treatment, Storage, and Disposal facilities (TSDF) shall be provided to the Owner within ten (10) days of disposal.

b. Weekly Waste Storage Area Inspection Documentation: On-site waste storage area(s) shall be inspected weekly by the Competent Person, who at a minimum satisfies the requirements set forth in Article 1.07D.2 of this Section;

1) Each weekly waste storage area inspection shall be coordinated with the applicable Owner personnel, documented in the form of a written report, and each report shall be signed by the Contractor's employee who generated the report. All reports shall be provided to the Owner within 24 hours of the date the inspection is completed. The content of

these reports shall include, but is not limited to, the following information:

a) The name of the individual who conducted the inspection;

b) Descriptions of waste streams being stored;

c) Types and quantities of waste containers being used;

d) The current recycling/disposal status (i.e., when the waste container is scheduled to be removed from the work site) and physical condition of each waste container;

e) The presence/absence of proper labeling for each waste container in accordance with Article 3.01I of this Section and federal, state, and local regulations;

f) Secondary containment(s) being used;

g) The methods being used to secure/lock each waste storage area to prevent any unauthorized entry;

h) The presence of any waste containers on site generated during the Work performed under this Section which violate RCRA generator storage time limitations, as defined in 40 CFR 262.

c. Waste Inventory Record: The Competent Person shall maintain an ongoing Waste Inventory Record. The Waste Inventory Record shall be coordinated with the applicable Owner Personnel. The content of the Waste Inventory Record shall include, but is not limited to, the following information:

1) Specific dates that each waste container was added and/or removed from the waste storage area;

2) The full name (printed) and signature of the individual responsible for adding and/or removing each waste container from the waste storage area.

2. Mercury Work Area Inspection Documentation: Work areas shall be inspected daily by the Competent Person, who at a minimum satisfies the requirements set forth in Article 1.07D.2 of this Section.

a. Each daily work area inspection shall be documented in the form of a written report, and each report shall be signed by the Contractor’s employee who generated the report. All reports shall be provided to the Owner within 24

hours of the date the inspection is completed. The content of these daily reports shall include, but is not limited to, the following information:

1) Type(s) of Work being performed;

2) Full names of Mercury Workers and the Competent Person on site as well as the name of the company each individual is representing;

3) Any non-compliance issues observed (i.e., observations that conflict with the requirements of the Contractor's Mercury Management Plan, this Section, and/or federal, state, and local regulations) along with the corrective actions that were taken to achieve compliance.

3. Contractor Project Record: The Contractor's Competent Person shall maintain a project record at the work Site. The Contractor's Project Record shall be made available to the Engineer or Owner for review at any time during the Work and shall be submitted to the Owner within 24 hours after the completion of the Work.

a. At a minimum, the Contractor Project Record shall contain the following information:

1) Copies of training certificates for all individuals involved with the Work;

2) Copies of all Mercury-Containing Materials survey reports relating to the Work;

3) Copies of all daily sign-in sheets as defined in Paragraph 4 of this Article;

4) A list of emergency phone numbers, including the local fire department, local police department, nearest hospital, as well as phone numbers for the Engineer and Owner personnel responsible for the administration of the Work;

5) A copy of EPA's Standard for Universal Waste Management (40 CFR 273);

6) A copy of NYSDEC's Standards for Universal Wastes (6 NYCRR 374-3) and Mercury-Added Consumer Product's Law (Chapter 145, Laws of New York, 2004);

7) Copies of all Safety Data Sheets (SDS) pertaining to all chemicals being used during the Work;

8) A copy of this Section and the related Drawings;

9) A copy of the Contractor's Mercury Management Plan as defined in Paragraph A.1 of this Article;

10) A copy of the Contractor's Waste Management Plan as defined in Paragraph A.2 of this Article;

11) Copies of all daily work area inspection records as defined in Paragraph 2 of this Article;

12) Copies of all Weekly Waste Storage Area Inspection records as defined in Paragraph 1.b of this Article;

13) A copy of the Waste Inventory Record as defined in Paragraph 1.c of this Article;

14) A copy of the Contractor's Hazard Communication Program as defined in Article Paragraph 5 of this Article;

4. Daily Sign-In Sheets: The Contractor shall generate daily sign-in sheets for all individuals entering and exiting each work area for the duration of the Work. The daily sign-in sheets shall be maintained by the Competent Person and shall be made available to the Engineer or Owner for review at any time during the Work. All daily sign-in sheets shall be submitted to the Owner within 24 hours after the completion of the Work.

   a. At a minimum, each daily sign-in sheet shall include:

      1) The individual's full name (printed);

      2) The individual's signature;

      3) The name of the company the individual is representing;

      4) The time of entry and exit from the area(s);

      5) Verification by the Competent Person that the individual meets the minimum training requirements defined in Article 1.07D.3 of this Section, if the individual intends to enter a Work area.

5. Hazard Communication Program: The Contractor shall establish and implement a Hazard Communication Program as required by 29 CFR 1910.1200. The Contractor's Hazard Communication Program shall be made available to the Engineer or Owner for review at any time during the Work.

1.05 PAYMENT

A. All costs associated with the removal and disposal of suspected/confirmed Mercury-Containing Materials and resulting Mercury Wastes as shown in Table 1 and Table 2 attached, and other unforeseen Mercury-Containing Materials and resulting Mercury Wastes that are not identified in Table 1 shall be reimbursed under a Hazardous Materials Allowance, as specified in Section 01 20 00 – Measurement and Payment.

B. Except for the allowance specified herein, no separate payment will be made for performing any other Work required under this Section and the Contractor shall include all costs thereof in the Lump Sum bid, as specified in Section 01 20 00 – Measurement and Payment.

C. Payment under the Lump Sum Bid for the disposal of Mercury-Containing Materials and Mercury Wastes will not be made until a signed copy of the manifest from the recycling facility/Treatment, Storage, and Disposal facility (TSDF), certifying the amount of Mercury-Containing Materials and Mercury Wastes delivered is returned with complete chain-of-custody documentation to the Owner.

D. The Owner will inspect the work performed, review the costs, and approve or reject requests for payment as provided by the General Conditions.

1.06 DEFINITIONS

A. Ceiling Limit: Defined by American Conference of Governmental Industrial Hygienists (ACGIH), as the concentration in air that workers could be repeatedly exposed to daily without adverse health effects.

B. Certified Industrial Hygienist (CIH): Refers to an Industrial Hygienist employed by the Contractor who is currently certified by the American Board of Industrial Hygiene (AHIA) in comprehensive practice.

C. Competent Person: Defined by OSHA as someone who is capable of identifying existing and predictable hazards in the surroundings or working conditions, and who has authorization to take prompt corrective measures to eliminate them. Duties of the Competent Person include the following:

1. Determining prior to the performance of the Work, what contaminants are present in the workplace;

2. Establishing work areas and assuring that access to and from those areas is limited to authorized personnel;

3. Assuring the adequacy of any employee Exposure Monitoring required by OSHA;

4. Assuring that all employees exposed to airborne contaminant levels above Action Levels, Permissible Exposure Limits (PELs), or Recommended Exposure Limits (RELs) wear appropriate Personal Protective Equipment (PPE), respiratory protection, and are trained in the use of appropriate methods of exposure control for all the contaminants present;

5. Assuring that proper Hygiene Facilities are provided and that workers are trained to use those facilities;

6. Assuring that engineering controls specific to the contaminants present are implemented, maintained in proper operating condition, and functioning properly.

D. DOT Hazardous Materials Transportation Training: Training that meets the criteria outlined in 49 CFR 172.704. This training shall include discussions from 49 CFR 174 of the following:

1. Hazardous materials tables within 49 CFR 172;

2. Material packaging and labeling within 49 CFR 178;

3. Shipping papers and placards within 49 CFR 173;

4. Material loading and segregation within 49 CFR 173.

E. Hazardous Waste Operations (HAZWOPER) Training: Training that meets the criteria outlined in the OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120). A minimum of 24-hour HAZWOPER training will be required for Work being performed under this Section. However, certain types of Work may require 40-hour HAZWOPER Training. All decisions regarding the specific HAZWOPER Training that will be required for each Work task shall be made by the Engineer.

F. High Efficiency Particulate Air (HEPA) Filter: A filter designed to remove 99.97% of all particles greater than 0.3 micrometers (µm) in diameter. For the purpose of this Section, HEPA vacuum and local exhaust filtration equipment used by the Contractor shall meet the Standard for Safety High-Efficiency, Particulate, Air Filter Units (UL 586) developed by Underwriters Laboratories.

G. Hygiene Facilities: Facilities within the Physical Boundary of a work area that are set up to prevent cross contamination and are equipped with change areas and separate storage facilities for PPE and clean clothing. Hygiene Facilities shall include adequately supplied hand washing station(s) (i.e., running water, soap, and clean towels) or shower(s) (hot and cold water that is controllable at the tap, soap, shampoo, and clean towels).

H. Mercury-Containing Material: Material or device that contains a detectable amount of elemental mercury, inorganic mercury compounds, or organic mercury compounds.

Mercury-Containing Materials may include, but are limited to, the following: batteries, light bulbs, thermometers, thermostats, barometers, manometers, temperature gauges, pressure gauges, and switches.

I. Mercury Awareness Training: Training for individuals that have the potential to be exposed to Mercury-Containing Materials or Mercury Wastes. This training shall include discussions of the following:

1. Sources of mercury;

2. Current federal, state, and local regulations pertaining to mercury;

3. The health effects of mercury exposure;

4. State-of-the-art work practices, engineering controls, and procedures for removal, materials handling, housekeeping, spills, and waste management activities that involve Mercury-Containing Materials and Mercury Wastes;

5. The use and maintenance of PPE and the use and maintenance of respirators in accordance with 29 CFR 1910.134;

6. Requirements regarding warning signs, labeling, and Safety Data Sheets (SDSs) in accordance with 29 CFR 1910.1200;

7. Responsibilities of the Competent Person.

J. Mercury Waste: Non-specific liquid or solid waste generated during the disturbance, removal, construction/demolition, handling, and cleanup of Mercury-Containing Materials.

K. P-100 Filter: (See definition of: “High Efficiency Particulate Air (HEPA) Filter”).

L. Physical Boundary: A physical barrier designated with ropes, red “do not enter tape,” or a partition that surrounds a work area in order to limit the entry of unauthorized personnel and delineate “clean areas” from areas that may meet or exceed an Action Level, PEL, or REL.

M. Recommended Exposure Limit (REL): An exposure limit recommended by the NIOSH that can be expressed as a Time-Weighted Average (TWA), Ceiling Limit, or Short-Term Exposure Limit (STEL). Once an REL is met or exceeded for a particular contaminant, the Contractor is responsible for ensuring that workers receive appropriate exposure monitoring, Personal Protective Equipment (PPE), including respiratory protection, hygiene facilities, medical surveillance, and training. The following REL is pertinent to removal, demolition, and disposal activities associated with Mercury-Containing Materials and Mercury Wastes:

1. Mercury – 0.05 mg/m^3 as a TWA for up to a ten (10) hour workday and a 40-hour work week, and a ceiling limit of 0.1 mg/m^3.

N. Resource Conservation and Recovery Act (RCRA) Training: Training that meets the criteria outlined in 40 CFR 265.16. This training shall include site-specific discussions of the following:

1. Hazardous waste identification;

2. Waste storage container use and labeling;

3. Waste storage area management;

4. Personal health and safety, including fire safety;

5. Manifesting and the off-site transportation of wastes;

6. Procedures for using, inspecting, repairing, and replacing emergency equipment and monitoring equipment;

7. Procedures for communicating with other employees and outside emergency response personnel;

8. Responses to fires or explosions;

9. Responses to leaks, spills, and potential groundwater contamination incidents;

10. The shutdown of operations

O. Short-Term Exposure Limit (STEL): Defined by American Conference of Governmental Industrial Hygienists (ACGIH),refer to the concentration to which it is believed that nearly all workers can be exposed continuously for a short period of time without suffering from 1) irritation, 2) chronic or irreversible tissue damage, 3) dose-rate-dependent toxic effects, or 4) narcosis of sufficient degree to increase the likelihood of accidental injury, impaired self-rescue, or materially reduced work efficiency.

P. Threshold Limit Value: Defined by American Conference of Governmental Industrial Hygienists (ACGIH), refer to airborne concentrations of chemical substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed, day after day, over a working lifetime, without adverse health effects

Q. Time-Weighted Average (TWA): The average time over a given work period (e.g., an 8-hour workday) of a person’s exposure to a chemical or agent. The average is determined by sampling for the chemical or agent throughout the time period.

R. Universal Waste: Any Mercury-Containing Material that meets the criteria outlined in the Standards for Universal Waste Management (40 CFR 273), the Standards for Universal Wastes (6 NYCRR 374-3), or the Mercury-Added Consumer Products Law (Chapter 145, Laws of New York, 2004). Per 40 CFR 273.4(b)(3), if the mercury is removed from a Mercury-Containing Material, the material can no longer be considered a Universal Waste and must be managed as a hazardous waste, or a determination must be made to characterize the material as non-hazardous.

1.07 QUALITY ASSURANCE

A. Scheduling: The Contractor shall coordinate and schedule all phases of the Work to be performed under this Section with the Engineer, subcontractors, material suppliers, and other parties as necessary to ensure the proper execution of the Work.

B. Compliance: In addition to the detailed requirements of this Section, the Contractor shall comply with all applicable regulations of federal, state, and local authorities pertaining to the disturbance, removal, construction/demolition, handling, storage, transportation, and recycling/disposal of Mercury-Containing Materials and Mercury Wastes. All matters regarding the interpretation of any regulations, standards, or policies shall be submitted to the Engineer for resolution before starting the Work. Where the requirements of this Section, or federal, state, or local regulations conflict or vary, the most stringent requirements or regulations shall apply. Work shall be coordinated as needed with 29 CFR 1926 and Division 02 Work.

C. Rejection of Non-Complying Items: The Owner reserves the right to reject items incorporated into the Work which fail to meet the specified minimum requirements. The Owner also reserves the right to reject Contractor submittal items that are deemed inappropriate or unacceptable by the Engineer or Owner. Submittal items that may be deemed inappropriate or unacceptable include proposed vendors or subcontractors (e.g., TSDFs, etc.) with previous regulatory citations/violations. The Owner further reserves the right, and without prejudice to other recourse, to accept non-complying items subject to an adjustment in the Contract amount, as approved by the Owner.

D. Qualifications:

1. Contractor and/or Mercury Removal Company: The Contractor and/or Mercury Removal Company shall have successfully completed at least two (2) projects of comparable scope and methodologies to the Work being performed under this Section within the past three (3) years. This experience shall be documented by identifying the following:

    a. The name, address, and phone number of each facility where the work was performed;

b. The name of the individual representing the owner who supervised the work at each facility;

c. The type(s) of facility where the work was performed;

d. The volume and type of each material that was abated and/or demolished;

e. The specific method(s) of abatement and/or demolition used at each facility (including the tools, technologies, and engineering controls employed);

f. The name of each Competent Person supervising the work on each project.

2. Competent Person: The Contractor and/or Mercury Removal Company shall have on staff and assigned to this Contract a Competent Person who shall be on-site during all mercury-related work activities. The Competent Person shall have the following qualifications:

a. Shall be able to fulfill the duties defined in Article 1.06C of this Section;

b. Shall have successfully completed DOT Hazardous Materials Transportation Training, as defined in Article 1.06D of this Section, within the past year in the form of either an initial course or a refresher course;

c. Shall have successfully completed HAZWOPER Training, as defined in Article 1.06E of this Section, within the past year in the form of either an initial course or a refresher course;

d. Shall have successfully completed Mercury Awareness Training, as defined in Article 1.06I of this Section, within the past year in the form of either an initial course or a refresher course;

e. Shall have successfully completed RCRA Training, as defined in Article 1.06N of this Section, within the past year in the form of either an initial course or a refresher course;

f. Shall have a minimum of two (2) years' experience with work involving mercury;

g. Shall have worked on at least three (3) projects of comparable scope and methodologies to the Work being performed under this Section.

3. Mercury Worker: The Contractor and/or Mercury Removal Company shall have on staff and assigned to this Contract a sufficient number of experienced and properly trained Mercury Workers, who shall have the following qualifications:

a. Shall have successfully completed DOT Hazardous Materials Transportation Training, as defined in Article 1.06D of this Section, within the past year in the form of either an initial course or a refresher course;

b. Shall have successfully completed Mercury Awareness Training, as defined in Article 1.06I of this Section, within the past year in the form of either an initial course or a refresher course;

c. Shall have a minimum of one (1) year of experience on projects involving mercury;

d. Shall have worked on at least three (3) projects of comparable scope and methodologies to the Work being performed under this Section.

1.08 SPECIAL REQUIREMENTS

A. Commencement of Work: Five (5) days prior to the proposed start of Work at each separate location, the Contractor shall notify the Engineer and the onsite safety staff. No Work may proceed at any location until authorized by the Engineer.

B. The Contractor shall coordinate any required equipment shutdowns with the Engineer prior to starting the Work.

C. Access Restrictions: The Contractor shall inform the Engineer of proposed access restrictions (i.e., areas or items of equipment which will not be accessible during the Work) and give them estimated time frames (including specific dates) of such proposed access restrictions. The Contractor shall be aware that other contractors may be at any of the work site. As a result, the Contractor shall not have exclusive rights to any work site and shall fully cooperate and coordinate this Work with the work of other contractors who may be on site. Therefore, the Contractor shall notify other contractors in advance of the disturbance, removal, construction/demolition, and disposal Work included herein, to provide them with sufficient time for coordination of interrelated items that are included in their contracts and that must be performed before, after, or in conjunction with the Work to be performed under this Section.

D. Unexpected Entry into a Work Area: In the event that Owner personnel must enter a work area for reasons unrelated to the supervision or inspection of Work being performed under this Section (e.g., under emergency conditions), the Contractor shall immediately stop work, cleanup any loose debris, and verify clearance level via air monitoring, so as to permit the safe entry by Owner personnel. Any disturbance of Mercury-Containing Materials or Mercury Wastes shall not proceed until all Owner personnel have exited from the work area.

E. Meetings: The Contractor shall visit and investigate the site, review the Contract Drawings, review this Section, and become familiar with any conditions which may affect the Work, as part of the pre-construction meeting and site inspection. The Contractor

shall hold all meetings with appropriate parties as scheduled and as otherwise necessary to accomplish the Work to be performed under this Section. In addition to the pre-construction meeting and site inspection, other meetings may be required or may be requested by the Engineer, including briefings with Owner personnel. Written documentation (i.e., “minutes”) of all meetings shall be generated by the Contractor, and copies shall be provided to the Owner within three (3) days following each meeting.

PART 2 – PRODUCTS

2.01 EQUIPMENT

A. Protective Work Clothing and Personal Protective Equipment (PPE): The Contractor shall provide personnel who have a potential to be exposed to Mercury-Containing Materials or Mercury Wastes, with appropriate PPE as prescribed by the Contractor’s Certified Industrial Hygienist.

B. High-Efficiency Particulate Air (HEPA) Filters: HEPA/P-100 filters used in HEPA vacuuming equipment must meet or exceed any manufacturer’s specifications and recommendations, as well as specifications presented in the Standard for Safety High Efficiency, Particulate, Air Filter Units (UL 586).

C. Waste Containers: Containers for the storage of all recyclable materials and wastes shall be DOT-approved and shall be provided by the Contractor.

PART 3 – EXECUTION

3.01 PROCESS AND PROCEDURES

A. Protection of Existing Work to Remain: All work involving the disturbance of lead paints/coatings, lead dusts, lead-containing materials, and lead wastes must be conducted without damage to, or contamination of equipment or surfaces within the lead control area(s) or other areas adjacent to the lead control area(s). All such damage or contamination shall be immediately corrected and cleaned up by the Contractor at the Contractor's expense.

B. Physical Boundary Delineation: The Contractor shall clearly delineate each lead control area and hazardous waste storage area with a physical boundary in accordance with Article 1.06L of this Section.

C. Signs: The Contractor shall post conspicuous warning signs at all approaches to lead control areas and hazardous waste storage areas. The signs shall be located at such a distance so that personnel may read the sign and take necessary precautions before entering a lead control area or hazardous waste storage area. Signs shall comply with federal, state, and local regulations, including the requirements of the OSHA Lead in Construction Standard (29 CFR 1926.62). At a minimum, each sign shall bear the following information in English and the predominant language that is spoken by the Contractor's employees if English is not spoken:

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING

D. Hygiene Facilities: The Contractor shall provide functional hygiene facilities in accordance with Article 1.06G of this Section, that are appropriate for the type(s) of work being performed under this Contract. The Contractor shall ensure that employees do not leave a lead control area wearing any potentially contaminated protective work clothing or Personal Protective Equipment (PPE). Using compressed air to dislodge dust from work clothing or PPE shall be strictly prohibited.

1. Showers: The Contractor shall provide shower facilities in accordance with 29 CFR 1926.62 and Article 1.06G of this Section, for use by employees whose airborne exposure to lead is above the Permissible Exposure Limit (PEL). When shower facilities are necessary, employees are required to shower at the end of the work shift each day prior to leaving the lead control area they are working in.

E. Utilities: The temporary use of any on-site utilities shall be subject to the approval of the Owner. The Contractor shall furnish all water needed for the lead project, as well as any temporary hookups and hoses necessary to supply water to a lead control area. Also, the Contractor shall supply any necessary heating equipment and water filtration devices necessary for the work. In addition, all temporary lighting and temporary electrical service to a lead control area shall be provided by the Contractor and shall be in weather-proof enclosures and be ground fault protected.

F. Work Area Preparation: The Contractor shall utilize HEPA-filtered vacuums, and wet methods during the initial cleaning of each work area. Prior to removal from each work area, all movable objects and mounted objects that can be removed shall be pre-cleaned using HEPA-vacuums and wet methods. Fixed objects that must remain within each work area shall be pre-cleaned using HEPA vacuums and wet methods, and subsequently covered with 6-mil polyethylene sheeting.

G. Prohibited Activities: Contractors shall not conduct activities that are prohibited by OSHA and EPA regulations. The following activities are prohibited, regardless of whether they are conducted subject to an exposure assessment and written compliance program:

1. Burning-off paints/coatings;

2. Using heat guns operating above 1100°F;

3. Dry machine sanding, grinding, or blasting paint without a HEPA vacuum exhaust tool;

4. Uncontained hydroblasting or high-pressure washing;

5. Welding painted/coated surfaces unless the paint/coating is removed at least 4-inches from area of heat application (per 29 CFR 1926.345(c)(1)), and local exhaust ventilation is used.

H. Test Patches: Prior to choosing the paint removal method(s) for paints/coatings, the Contractor shall perform test patches on surfaces subject to Abatement, to determine if the method(s) meet the requirements of this Section.

I. Labeling: The Contractor shall affix warning labels to all lead waste containers (e.g., drums, etc.). Labels shall comply with the requirements of federal, state, and local regulations, including the EPA and DOT requirements. At a minimum, each label shall bear the following information in English:

HAZARDOUS WASTE
FEDERAL LAW PROHIBITS IMPROPER DISPOSAL
HANDLE WITH CARE
[Generator Name, Address, and Telephone Number]
[Specific Contents of Container]
[EPA-Issued Generator Identification Number]
[EPA Waste Identification Number]
[Accumulation Start Date]
[Accumulation End Date]

If waste classification is pending analysis, labels shall indicate “Hazardous Waste - Pending Analysis.”

J. Scaffolding: The Contractor shall furnish all the scaffolding of whatever type is necessary to do the work of this Contract, subject to requirements of the OSHA Safety Requirements for Scaffolding (29 CFR 1910.28), and the approval of the Engineer. Scaffolding shall be inspected after its construction but prior to use by a Contractor employee, who is an individual qualified as a Competent Person to inspect scaffoldings, as defined by OSHA.

K. Air Monitoring: Air monitoring for airborne concentrations of lead and other toxic metals to be determined by the Engineer (e.g., cadmium during demolition of cadmium-quenched bolts and pipe hangars) shall be conducted by the Air Sampling Technician in accordance with OSHA and Articles **Error! Reference source not found.** and Article REF _Ref141963474 \r \h * MERGEFORMAT **Error! Reference source not found.** of this Section.

1. Exposure Monitoring: For Work involving the disturbance of any detectable concentration of Lead or other heavy metals, the Contractor shall collect personal air samples from employees who are anticipated to have the greatest risk of exposure, as determined by the Certified Industrial Hygienist or Competent Person. Personal air samples shall be collected during every work shift from at least one (1) employee that is representative of each type of work task that is being performed. Each personal air sample will “run” for the employee’s entire work shift in order to ensure that enough volume (of air) is collected, and an accurate 8-hour TWA can be calculated. Documentation regarding the sample numbers, specific shift when the sampling was conducted, the work task(s) that were sampled, the date(s) of sampling, the employee hours that were worked during the shift, and the total sampling time(s), shall accompany each laboratory chain-of-custody form.

2. Area Monitoring: The Contractor shall collect a minimum of two (2) area air samples outside of each lead control area on a daily basis for the duration of the lead abatement work and any work involving the disturbance (e.g., demolition) of lead paints/coatings, lead dusts, lead-containing materials, or lead wastes. During sampling activities, all air sample filter cassettes shall be positioned approximately five to six feet above the ground (in order to simulate an individual’s breathing zone) and shall not be placed immediately adjacent to obstructions (e.g., walls or columns) which may restrict the flow of air to the filter cassette. If area air monitoring indicates an emission level in excess of 30 µg/m3 of air outside a lead control area, all lead work in that area shall be stopped immediately. The Contractor shall then take immediate corrective action to reduce emission levels to below 30 µg/m3 of air, and the Contractor shall clean all adjacent areas that may have become contaminated due to the emission. If lead abatement work or work involving the disturbance (e.g., demolition) of lead paints/coatings, lead dusts, lead-containing materials, or lead wastes is performed outside of a building/structure, or if dusts generated from the work are exhausted outside of the building/structure where the work is taking place, additional area monitoring must be performed to ensure compliance with NYSDEC ambient air quality standards. Documentation regarding the sample numbers, sample locations, the date of sampling, the employee hours that were worked during the shift, and the total sampling times, shall accompany each laboratory chain-of-custody form.

3. Documentation: Complete documentation of all air sampling activities shall be in accordance with Article **Error! Reference source not found.** of this Section.

4. The Contractor shall submit all air monitoring results to the Owner within 24 hours from when the air samples were collected.

3.02 CLEANUP AND DISPOSAL

A. Cleanup: The Contractor shall maintain all surfaces, including protective coverings (polyethylene sheeting) within each work area, free of accumulations of debris, dusts, and wastes. The Contractor shall perform housekeeping activities daily throughout each work shift and at the end of each work shift, in order to prevent any accumulation of debris, dusts, and wastes in the work areas. Using compressed air to cleanup a work area shall be strictly prohibited. HEPA-filtered vacuums and wet methods shall be used to ensure that each work area remains free of visible debris, dust, and wastes.

B. Collection, Separation, and Containerization of Wastes: The Contractor shall collect, separate (by waste stream/waste type), and containerize Mercury Wastes (solid and liquid), debris, PPE, and containment materials on a daily basis in accordance with the Mercury management plan.

1. The Contractor shall store all wastes in DOT-approved container systems. No drum/container shall be filled in excess of the capacity marked on the drum/container. All drums/containers shall be sealed and covered immediately after filling, and each drum/container will have a label affixed to it in accordance with Paragraph D of this Article. All labels shall remain intact and legible at all times.

2. No water mixed with or contaminated by mercury may be released onto the ground or into any drain or sewer. It should be noted that a discharge of more than 1 lb. of mercury onto the ground or into the water within a 24-hour period, shall be considered a violation of the Clean Water Act and shall be treated as a “reportable quantity” in accordance with 40 CFR 117. Such a release shall be grounds for immediate termination of this Contract and the Contractor shall be liable for any fines, penalties, or remediation costs.

3. Any quantity of elemental mercury that is released or spilled must be immediately reported to the Owner. Reporting to NYSDEC Spill Hotline is required for a release of one pound (approximately two tablespoons) or more.

4. The Contractor shall store non-mercury-containing wastes separately from mercury-containing wastes, shall provide all non-mercury-containing waste containers, and

C. Storage of Wastes: The Contractor shall ensure that all drummed wastes are stored in a secondary containment system, and that each waste storage area is demarcated with a Physical Boundary in accordance with this Section. In addition, the Contractor shall post

weekly waste inspections and waste inventories in the hazardous waste storage area, as defined in this Section, as well as the following emergency information:

1. The name and telephone number of the facility's Emergency Coordinator;

2. The location of fire extinguishers and fire alarms;

3. The location of spill control materials;

4. The telephone number for the fire department (unless the facility has a direct alarm).

D. Labeling: The Contractor shall affix warning labels to all mercury recycling/waste drums and containers. Labels shall comply with the requirements of federal, state, and local regulations, including EPA and DOT requirements. At a minimum, all labels shall bear the following information in English:

Generator Name, Address, and Telephone Number]

[Specific Contents of Container]

[Accumulation Start Date]

[Accumulation End Date]

1. If necessary (i.e., if waste is to be disposed of as hazardous waste rather than Universal Waste), also include the following information on the label:

HAZARDOUS WASTE

FEDERAL LAW PROHIBITS IMPROPER DISPOSAL

HANDLE WITH CARE

[EPA-Issued Generator Identification Number]

[EPA Waste Identification Number]

E. Characterization and Disposal of Wastes: Mercury-Containing Materials to be removed under the Work of this Section shall be recycled in accordance with the EPA's Standards for Universal Waste Management (40 CFR 273), the NYSDEC's Standards for Universal Wastes (6 NYCRR 374-3), and the NYSDEC's Mercury-Added Consumer Products Law (Chapter 145, Laws of New York, 2004). If a material is not regulated as a Universal Waste, the material shall be considered a hazardous waste, and shall be disposed of in accordance with RCRA requirements.

1. All waste profiles for containerized wastes must be reviewed by the Engineer and signed by the Owner as the generator of the waste streams. The Contractor shall notify the Owner at least 14 days prior to the removal of any waste drums/containers, so that the Owner can inspect the drums/containers and review and approve advance copies of all waste manifests. Hazardous wastes shall be disposed of to ensure that drums/containers do not remain on the job site for more than 90 calendar days from the initial “accumulation start date” on the label affixed to the drum/container. Universal Wastes shall be disposed of to ensure that drums/containers do not remain on the job site for more than one (1) year from the initial “accumulation start date” on the label affixed to the drum/container. Containers that have reached their storage capacity shall not remain on site and transportation arrangements shall be made for their immediate removal.

F. Disposal Documentation: The Contractor shall submit written evidence that the recycling facility/TSDF receiving Mercury-Containing Materials or Mercury Wastes is approved by federal, state, and local regulatory agencies to receive the materials/wastes. Once all waste profiles have been completed, the Contractor shall provide the Owner with a “Letter of Acceptance” issued by the TSDF indicating that the wastes will be accepted. On the date of disposal, the Contractor shall submit one (1) copy of the completed manifest, that has been signed and dated by the initial transporter in accordance with 6 NYCRR 372 and 40 CFR 262, to the Owner for signature as Generator. All waste profiles, manifests, and Land Disposal Restrictions (LDRs) per 6 NYCRR 376 and 40 CFR 268 must be signed by Owner personnel per Section 01 35 45 – Hazardous Materials Control.

END OF SECTION

TABLE 1: OTHER REGULATED WASTES

Area/Equipment	*Description*	*Waste Classification*	*Quantity*
Mechanical Screen Building, Dumpster cRoom	Lighting bulb Lighting ballast	Universal waste Non-hazardous TSCA regulated waste (if PCBs), Non-hazardous regulated waste (if no PCBs)	2 bulbs 2 ballasts
Mechanical Screen Building, Screen Chamber	Lighting bulb Lighting ballast	Universal waste Non-hazardous TSCA regulated waste (if PCBs), Non-hazardous regulated waste (if no PCBs)	9 bulbs 9 ballasts
	Fire extinguisher	Universal waste	2 extinguishers
Mechanical Screen Building, Electrical Room	Lighting bulb Lighting ballast	Universal waste Non-hazardous TSCA regulated waste (if PCBs), Non-hazardous regulated waste (if no PCBs)	6 bulbs 3 ballasts
	Fire extinguisher	Universal waste	2 extinguishers
	Lead batteries	Universal waste	2 batteries

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SECTION 03 01 30

CONCRETE REPAIRS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish all materials, labor, equipment, tools, etc., required for the repair, renovation, and replacement of concrete and/or reinforcing steel as indicated on the Drawings, specified herein, and determined by field survey.

B. The Contractor, in conjunction with the Engineer, shall determine the extent of cracked or deteriorated concrete to be rehabilitated and/or resurfaced. A summary of the work to be performed shall be submitted to the Engineer for review, and such summary shall be approved by the Engineer prior to commencement of the Work.

C. Concrete repairs include the following:

1. Repair concrete deficiencies in the Mechanical Screen Room as specified on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Division 01 – General Requirements

B. Section 01 20 00 – Measurement and Payment

C. Division 03 – Concrete

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Shall be as specified in Section 01 42 00 – References.

B. ICRI CSP – International Concrete Repair Institute Concrete Surface Profile.

1.04 SUBCONTRACTOR/APPLICATOR QUALIFICATIONS

A. The Contractor shall furnish the name of all subcontractors/applicators which he proposes to use for this work, including necessary evidence and/or experience records to ascertain their qualifications in the application of epoxy, urethane, and polymer-modified and silica fume enhanced repair materials.

B. Approved applicator qualifications shall include a minimum of 5 years of experience in applying epoxy, urethane, and polymer-modified and silica fume enhanced cement-based repair materials like those materials specified in this Section.

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C. A letter from the manufacturer of the specified materials, on the manufacturer's letterhead, signed by an officer of the company, stating that the subcontractor/applicator has been trained in the proper techniques for applying the product, including surface

preparation and mixing, placing, curing, and caring for the manufacturer's products shall be submitted. This letter shall further state that the subcontractor/applicator is on the manufacturer's approved list of contractors.

1.05 SUBMITTALS

A. Material certifications and technical data sheets on all grouts, mortars, epoxy resins, aggregates and repair products specified in this Section.

B. Subcontractor/Applicator qualifications as specified in Article 1.04 of this Section.

C. Shop Drawings detailing any planned deviation from the proposed construction sequence and/or method of repair.

D. The Contractor, based on their experience in their profession, and/or recommendation from product manufacturers, may submit to the Engineer for approval, alternative materials and/or methods of work to assure the durability and watertight integrity of the repair work performed.

E. Detailed repair procedures for each repair type.

F. Letter from repair material manufacturer(s) certifying that all repair materials to be used to create single repairs are compatible for use together

1.06 ADDITIONAL GUARANTEE

A. The Contractor shall guarantee all repair work performed under this Contract against defects in workmanship resulting in leakage and/or failure of concrete bond for a period of three (3) years from the date of the Certificate of Substantial Completion.

PART 2 – MATERIALS

2.01 GENERAL

A. All concrete repair materials, when used in combination to create a single repair, shall be compatible.

2.02 WATER

A. The water used for mixing concrete repair products shall be clear, potable, and free of deleterious substances.

2.03 AGGREGATE

A. All aggregate shall conform to ASTM C-33. The aggregate supplier shall submit to the Engineer documentation that the proposed aggregates comply with ASTM C-33 and the requirements listed below:

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B. Pea Gravel - Pea gravel shall meet the gradation and material requirements of Standard Size 14 as defined by ASTM C-33. Pea gravel shall be clean and free from deleterious matter and shall contain no limestone.

2.04 EPOXY BONDING AGENT

A. Epoxy bonding agent shall conform to ASTM C-881 Type I, II, IV or V; Grade 2 for epoxy resin adhesives, depending on the application. The class of epoxy bonding agent shall be suitable for all ambient and substrate temperatures. The epoxy resin shall be:

1. "Sikadur Hi-Mod Series" as manufactured by the Sika Corp, Lyndhurst, NJ;
2. "Duralbond" as manufactured by Euclid Chemical Company, Cleveland, OH;
3. "Euco #452 Series" as manufactured by the Euclid Chemical Company;
4. "MasterEmaco ADH series" as manufactured by Master Builders Solutions;
5. Or approved equal.

2.05 ANTI-CORROSION REBAR COATING

A. Anti-corrosive coating shall be a polymer-modified cementitious material such as:

1. "Sika Armatec 110 EpoCem " as manufactured by Sika Corp., Lyndhurst, NJ,
2. "Duralprep A.C." as manufactured by the Euclid Chemical Company;
3. "MasterEmaco P 124" as manufactured by Master Builders Solutions;
4. Or approved equal.

2.06 TYPE I CRACK REPAIR - CEMENTITIOUS SURFACE SEAL

A. Type I Crack Repair - Cementitious Surface Seal shall be a polymer-modified or silica fume enhanced trowel grade cementitious. Type I Crack Repair material shall be:

1. "Sikatop 123 Plus" as manufactured by Sika Corp., Lyndhurst, NJ;
2. "Verticoat" or "Verticoat Supreme" as manufactured by Euclid Chemical Company;
3. "Emaco S88 CI" as manufactured by Master Builders Solutions;
4. Or approved equal.

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2.07 TYPE II CRACK REPAIR – EPOXY INJECTION CRACK REPAIR

A. Type II Crack Repair – Epoxy Injection Crack Repair shall be a 100% solids, high-modulus, low viscosity, moisture insensitive epoxy adhesive designed for structural repair. The epoxy adhesive shall be

1. "Sikadur 52" as manufactured by Sika Corp., Lyndhurst, NJ;
2. "Duralcrete LV" as manufactured by Euclid Chemical Company, Cleveland, OH;
3. “Eucopoxy Injection Resin” as manufactured by the Euclid Chemical Company;
4. “MasterInject 1500” as manufactured by Master Builders Solutions;
5. Or approved equal.

2.08 TYPE III CRACK REPAIR - WATERPROOF INJECTION GROUT

A. Type III Crack Repair - Waterproof Injection Grout shall be a one-component, water-activated, extra-low viscosity polyurethane or methacrylic acrylate hydrophilic/hydrophobic injection grout capable of 400% expansion. Injection grout shall form a tough flexible/rigid foam seal that is impenetrable to water.

B. Hydrophilic injection grout shall be:

1. “MasterInject 1210” as manufactured by Master Builders Solutions;
2. "Prime Flex 900 XLV" as manufactured by Prime Resins, Conyers, GA;
3. "AV-330 Safeguard" as manufactured by Avanti International, Webster, TX;
4. "DeNeef Sealfoam PURe" or “Gelacryl Superflex” as manufactured by Grace Construction Products/GCP Applied Technologies;
5. “SikaFix HH Hydrophilic” as manufactured by Sika Corp., Lyndhurst, NJ;
6. Or approved equal.

C. Hydrophobic injection grout shall be:

1. “MasterInject 1230” as manufactured by Master Builders Solutions;
2. "Prime Flex 940" as manufactured by Prime Resins, Conyers, GA;
3. "Sikafix HHLV or “Sikafix HH+” manufactured by Sika Corp., Lyndhurst, NJ;
4. "AV-248-LV Flexseal LV" as manufactured by Avanti International, Webster, TX;

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5. "DeNeef Flex SLV one or PURe" as manufactured by Grace Construction Products;

6. Or approved equal.

2.09 SPALL REPAIR PATCHING MATERIAL

A. All spall repairs not requiring formwork shall be repaired using a polymer-modified cementitious mortar and shall have a minimum 28-day compressive strength of 7,000 psi.

B. Spall repair mortar for use in horizontal applications shall be:

1. "Sikatop 122 Plus" as manufactured by Sika Corp., Lyndhurst, NJ,

2. “Eucocrete Supreme” or “Duraltop Flowable Mortar” as manufactured by the Euclid Chemical Company,

3. “MasterEmaco T-302” or “MasterEmaco T310CI” as manufactured by Master Builders Solutions;

4. Or approved equal.

C. Spall repair mortar for use in vertical and overhead applications shall be:

1. "Sikatop 123 Plus" as manufactured by Sika Corp., Lyndhurst, NJ;

2. “Verticoat or Verticoat Supreme” as manufactured by the Euclid Chemical Company;

3. “MasterEmaco N 425” or “MasterEmaco N 400” as manufactured by Master Builders Solutions;

4. Or approved equal.

D. All spall repairs requiring formwork shall be repaired using a polymer-modified cementitious mortar/pea gravel mixture and shall have a minimum 28-day compressive strength of 7,000 psi. Spall repair mortar shall be:

1. "SikaTop 111 PLUS"as manufactured by Sika Corp., Lyndhurst, NJ;

2. "Eucocrete Supreme” as manufactured by Euclid Chemical Company, Cleveland, OH;

3. “MasterEmaco T 310 CI” as manufactured by Master Builders Solutions;

4. Or approved equal.

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2.10 CEMENT BASED TEXTURED COATING

A. Cement based textured coating shall have a minimum durability of 10 years and be able to seal cracks with a width up to 1/8 inch.

B. Cement based textured coating shall be:

1. "SikaTop 144" as manufactured by Sika Corp., Lyndhurst, NJ;

2. “MasterSeal 581” as manufactured by Master Builders Solutions;

3. "Duraltop Coating" as manufactured by the Euclid Chemical Company, Cleveland, OH,

4. “Eucoseal or Tamoseal” as manufactured by the Euclid Chemical Company;

5. Or approved equal.

2.11 OTHER MATERIALS

A. OAKUM ROPE – Oakum rope shall be dry type oakum or jute intended for use with polyurethane grouts for sealing cracks and gaps in concrete and shall be:

1. “DeNeef Dry Oakum” as manufactured by Grace Construction Products/GCP Technologies;

2. Or approved equal.

2.12 STORAGE OF MATERIALS

A. The Contractor shall provide an area for repair material storage free from exposure to moisture in any form, before, during, and after delivery to the site. Manufactured materials shall be delivered in unbroken containers labeled with the manufacturer's name and product type. All mortar products shall be stored on raised platforms. Materials susceptible to damage by freezing shall be stored in a dry, heated, insulated area. Any material that has hardened, partially set, become caked and/or has been contaminated or deteriorated shall be rejected. All aggregates shall be stored in clean bins, scows or platforms.

PART 3 – INSTALLATION

3.01 GENERAL REQUIREMENTS

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A. No repair work shall be undertaken when ambient temperatures are below manufacturer's safe recommendations. No admixtures, except those required by the manufacturer, shall be used in the repairs specified herein.

B. All products shall be applied in strict accordance with manufacturer's recommendations. The Contractor shall furnish and install safe scaffolding and ladders for the Engineer's prework inspection, the repair work activities, and the Engineer's final inspection.

C. Sandblast or waterblast (3000-5000 psi waterjet) or use low impact hand chipping tools to clean deteriorated areas to remove all loose concrete, existing coatings, unsound material, debris, and laitance. All surfaces shall be clean, free of dirt, grease, loose particles, and deleterious substances and shall be prepared according to manufacturer's requirements.

3.02 EPOXY BONDING AGENT

A. An epoxy bonding agent shall be used when applying fresh concrete to previously placed concrete unless otherwise recommended by the manufacturer.

B. Existing concrete surfaces shall be roughened (1/16” or CSP 5 minimum profile) unless otherwise recommended by the manufacturer prior to application of bonding agent. Concrete surface shall be clean and sound, free of all foreign particles and laitance. Repair material shall be placed while bonding agent is still tacky. If bonding agent cures prior to placement of repair material, bonding agent shall be reapplied.

C. Repairing concrete with epoxy mortars shall conform to all the requirements of ACI 503.4 "Standard Specification for Repairing Concrete with Epoxy Mortars" (latest edition), except as modified herein.

3.03 ANTI-CORROSION REBAR COATING

A. Reinforcing steel cut or exposed during demolition and/or repair operations shall be sandblasted and cleaned prior to coating with an anti-corrosive coating. Anti-corrosive coating shall be applied as soon as the reinforcement is exposed and cleaned. Coating shall thoroughly cover all exposed parts of the steel and shall be applied according to manufacturer's recommendations.

3.04 TYPE I CRACK REPAIR – CEMENTITIOUS SURFACE SEAL

A. Where indicated on the Drawings, or as directed by the Engineer, existing nonstructural cracks 1/16" and wider in vertical and overhead surfaces or existing cracks between 1/16" and 1/4" wide in horizontal surfaces shall be repaired with Type I Crack Repair Material. Rout crack to 3/4" wide by 3/4" deep V-notch to expose sound concrete. Provide a 3/8” high vertical shoulder at the top of notch on each side. Where rebar has deteriorated, or where deteriorated concrete extends below the top of rebar, crack shall be routed to expose 3/4" all around rebar. The resulting void in concrete shall be patched flush with the existing concrete surface using Type I Crack Repair material.

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3.05 TYPE II CRACK REPAIR – EPOXY INJECTION

A. Vertical and Overhead Surfaces

1. Where indicated on the Drawings, or as directed by the Engineer, existing structural cracks 1/4" wide or narrower shall be repaired by pressure injecting Type II Crack Repair material into the prepared crack. Seal crack surface using epoxy resin binder and install injection ports per manufacturer's recommendations. Holes drilled for injection ports shall not cut rebar. If rebar is encountered during drilling, the hole shall be abandoned and relocated, and the abandoned hole shall be patched immediately with non-shrink grout flush with the surface of the existing concrete. Once the surface sealing material has fully cured, inject crack with Type II Crack Repair material using standard pressure injection equipment as directed by the manufacturer.

B. Horizontal Surfaces

1. Where indicated on the Drawings, or as directed by the Engineer, existing structural cracks 1/4" wide or narrower shall be repaired using Type II Crack Repair by pressure injecting Type II Crack Repair material into the prepared crack. Seal crack surface using epoxy resin binder and install injection ports per manufacturer's recommendations. Holes drilled for injection ports shall not cut rebar. If rebar is encountered during drilling, the hole shall be abandoned and relocated, and the abandoned hole shall be patched immediately with non-shrink grout flush with the surface of the existing concrete. Once the surface sealing material has fully cured, inject crack with Type II Crack Repair material using standard pressure injection equipment as directed by the manufacturer.

2. Where indicated on the Drawings, or as directed by the Engineer, existing structural cracks wider than 1/4" shall be repaired by gravity feeding Type II Crack Repair material into the prepared crack. First rout the concrete surface to form a 1/4" wide by 1/4" deep v-notch and clean the crack to remove all loose and foreign particles. Fill the crack with clean, dry sand and then pour structural crack repair binder into V-notch, completely filling crack. As binder penetrates crack, additional binder shall be applied to the V-notch.

3.06 TYPE III CRACK REPAIR – WATERPROOF INJECTION GROUT

A. Existing, leaking cracks 1/4" or smaller, identified as nonstructural by the Engineer, shall be repaired by pressure injecting a Type III Crack Repair material into the prepared crack. Seal crack surface with epoxy binder and install injection ports per manufacturer's recommendations. Holes drilled for injection ports shall not cut rebar. If rebar is encountered during drilling, the hole shall be abandoned and relocated, and the abandoned hole shall be patched immediately with non-shrink grout flush with the surface of the existing concrete. Once the surface sealing material has cured, clean, potable water shall be injected into the ports to flush the crack and provide the water

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necessary for chemical reaction of the grout. Immediately following injection of water, inject the crack with Type III Crack Repair material using standard pressure injection equipment as directed by the manufacturer.

B. All existing, leaking cracks larger than 1/4", not identified as structural by the Engineer, shall be repaired by first soaking oakum rope or open cell backer rod in waterproof injection grout, and then tightly packing the soaked oakum into the crack so as to completely fill the crack.

3.07 SPALL REPAIR PATCHING MATERIAL

A. All voids or spalled areas to be repaired shall be chipped back to sound concrete a minimum 1/8" deep, with a minimum surface profile of CSP-5, cleaned and repaired with spall repair patching material according to manufacturer's recommendations. All patching shall provide a final finished surface which is flat, level and even with the existing concrete surface. Repair mortar shall not be feathered to meet existing concrete surface. Prior to commencing repair surface preparation, saw cut or grind a 1/2" deep groove around the perimeter around the repair area, perpendicular to the finished concrete surface to provide a square shoulder to the repair area. Repair areas shall be formed using clean, straight rectangular edges where possible. Final patching on horizontal surfaces shall receive a broom finish consistent with the finish on the existing structure.

3.08 CEMENT BASED TEXTURED COATING

A. Thoroughly clean the concrete substrate and apply cement based textured coating according to manufacturer's recommendations. All necessary concrete repairs as detailed on the Contract Drawings shall be completed prior to applying coating.

3.09 CURING

A. All repair products shall be cured in strict accordance with manufacturer recommendations. Wet curing is preferred where possible.

3.10 WORK IN CONFINED SPACES

A. The Contractor shall provide and maintain safe working conditions for all employees and subcontractors. Fresh air shall be supplied continuously to confined spaces through the combined use of existing openings, forced-draft fans and temporary ducts to the outside, or by direct air supply to individual workers. Fumes shall be exhausted to the outside from the lowest level of the confined space. Electrical fan motors shall be explosion-proof if in contact with fumes. No smoking or open fires shall be permitted in or near areas where volatile fumes may accumulate.

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SECTION 03 11 00
CONCRETE FORMWORK

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Provide materials, labor, and equipment required for the design and construction of all concrete formwork, bracing, shoring and supports in accordance with the provisions of the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03 15 00 – Concrete Accessories

B. Section 03 15 16 – Joints in Concrete

C. Section 03 21 00 – Reinforcing Steel

D. Section 03 30 00 – Cast-in-Place Concrete

E. Section 03 35 00 – Concrete Finishes

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. New York State Building Code
2. ACI 318 – Building Code Requirements for Structural Concrete
3. ACI 301 – Specifications for Structural Concrete
4. ACI 347 – Recommended Practice for Concrete Formwork
5. U.S. Product Standard for Concrete Forms, Class I, PS 1
6. ACI 117 – Specification for Tolerances for Concrete Construction and Materials and Commentary

1.04 SUBMITTALS

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A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures.

1. Manufacturer's data on proposed form release agent

2. Manufacturer's data on proposed formwork system including form ties

1.05 QUALITY ASSURANCE

A. Concrete formwork shall be in accordance with ACI 301, ACI 318, and ACI 347.

PART 2 – PRODUCTS

2.01 FORMS AND FALSEWORK

A. All forms shall be smooth surface forms unless otherwise specified.

B. Wood materials for concrete forms and falsework shall conform to the following requirements:

1. Lumber for bracing, shoring, or supporting forms shall be Douglas Fir or Southern Pine, construction grade or better, in conformance with U.S. Product Standard PS20. All lumber used for forms, shoring or bracing shall be new material.

2. Plywood for concrete formwork shall be new, waterproof, synthetic resin bonded, exterior type Douglas Fir or Southern Pine high density overlaid (HDO) plywood manufactured especially for concrete formwork and shall conform to the requirements of PS1 for Concrete Forms, Class I, and shall be edge sealed. Thickness shall be as required to support concrete at the rate it is placed, but not less than 5/8-inch thick.

C. Other form materials such as metal, fiberglass, or other acceptable material that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line and grade indicated may be submitted to the Engineer for approval, but only materials that will produce a smooth form finish equal or better than the wood materials specified will be considered.

2.02 FORMWORK ACCESSORIES

A. Form ties shall be provided with a plastic cone or other suitable means for forming a conical hole to ensure that the form tie may be broken off back of the face of the concrete. The maximum diameter of removable cones for rod ties, or of other removable form-tie fasteners having a circular cross-section, shall not exceed 7/8-inch, and all such fasteners shall be such as to leave holes of regular shape for reaming.

B. Form ties for water-retaining structures shall have integral waterstops. Removable taper ties may be used when acceptable to the Engineer. A preformed mechanical EPDM rubber plug shall be used to seal the hole left after the removal of the taper tie. Plug shall be X-Plug by the Sika Corporation or approved equal. Friction fit plugs shall not be used.

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C. Form release agent shall be a blend of natural and synthetic chemicals that employs a chemical reaction to provide quick, easy and clean release of concrete from forms. It shall not stain the concrete and shall leave the concrete with a paintable surface. Formulation of the form release agent shall be such that it would minimize formation of "bug holes" in cast-in-place concrete.

PART 3 – EXECUTION

3.01 FORM DESIGN

A. Forms and falsework shall be designed for total dead load, plus all construction live load as outlined in ACI 347. Design and engineering of formwork and safety considerations during construction shall be the responsibility of the Contractor.

B. Forms shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete. The maximum deflection of facing materials reflected in concrete surfaces exposed to view shall be 1/240 of the span between structural members.

C. All forms shall be designed for predetermined placing rates per hour, considering expected air temperatures and setting rates.

3.02 CONSTRUCTION

A. The type, size, quality, and strength of all materials from which forms are made shall be subject to the approval of the Engineer. No falsework or forms shall be used which are not clean and suitable. Deformed, broken or defective falsework and forms shall be removed from the work.

B. Forms shall be smooth and free from surface irregularities. Suitable and effective means shall be provided on all forms for holding adjacent edges and ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete. Joints between the forms shall be sealed to eliminate any irregularities. The arrangement of the facing material shall be orderly and symmetrical, with the number of seams kept to a practical minimum.

C. Forms shall be true to line and grade and shall be sufficiently rigid to prevent displacement and sagging between supports. Curved forms shall be used for curved and circular structures. Straight panels joined at angles will not be acceptable for forming curved structures. Forms shall be properly braced or tied together to maintain their position and shape under a load of freshly placed concrete. Facing material shall be supported with studs or other backing which shall prevent both visible deflection marks in the concrete and deflections beyond the tolerances specified.

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D. Forms shall be mortar tight to prevent the loss of water, cement and fines during placing and vibrating of the concrete. Specifically, the bottom of wall forms that rest on concrete footings or slabs shall be provided with a gasket to prevent loss of fines and paste during placement and vibration of concrete. Such gasket may be a 1 to 1-1/2-inch diameter polyethylene rod held in position to the underside of the wall form.

E. All vertical surfaces of concrete members shall be formed, and side forms shall be provided for all footings, slab edges and grade beams, except where placement of the concrete against the ground is called for on the Drawings. Not less than 1-inch of concrete shall be added to the thickness of the concrete member as shown where concrete is permitted to be placed against trimmed ground in lieu of forms. Such permission will be granted only for members of comparatively limited height and where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing until the concrete has been placed.

F. All forms shall be constructed in such a manner that they can be removed without hammering or prying against the concrete. Wood forms shall be constructed for wall openings to facilitate loosening and to counteract swelling of the forms.

G. Adequate clean-out holes shall be provided at the bottom of each lift of forms. Temporary openings shall be provided at the base of column forms and wall forms and at other points to facilitate cleaning and observation immediately before the concrete is deposited. The size, number and location of such clean-outs shall be as acceptable to the Engineer.

H. Construction joints shall not be permitted at locations other than those shown or specified, except as may be acceptable to the Engineer. When a second lift is placed on hardened concrete, special precautions shall be taken in the way of the number, location and tightening of ties at the top of the old lift and bottom of the new to prevent any unsatisfactory effect whatsoever on the concrete. For flush surfaces at construction joints exposed to view, the contact surface of the form sheathing over the hardened concrete in the previous placement shall be lapped by not more than 1 inch. Forms shall be held against hardened concrete to prevent offset or loss of mortar at construction joints and to maintain a true surface.

I. The formwork shall be cambered to compensate for anticipated deflections in the formwork due to the weight and pressure of the fresh concrete and due to construction loads. Set forms and intermediate screed strips for slabs accurately to produce the designated elevations and contours of the finished surface. Ensure that edge forms and screed strips are sufficiently strong to support vibrating screeds or roller pipe screeds if the nature of the finish specified requires the use of such equipment. When formwork is cambered, set screeds to a like camber to maintain the proper concrete thickness.

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J. Positive means of adjustment (wedges or jacks) for shores and struts shall be provided and all settlement shall be taken up during concrete placing operation. Shores and struts shall be securely braced against lateral deflections. Wedges shall be fastened firmly in

place after final adjustment of forms prior to concrete placement. Formwork shall be anchored to shores or other supporting surfaces or members to prevent upward or lateral movement of any part of the formwork system during concrete placement. If adequate foundation for shores cannot be secured, trussed supports shall be provided.

K. Runways shall be provided for moving equipment with struts or legs. Runways shall be supported directly on the formwork or structural member without resting on the reinforcing steel.

3.03 TOLERANCES

A. Unless otherwise indicated in the Contract Documents, formwork shall be constructed so that the concrete surfaces will conform to the tolerance limits listed in ACI 117.

B. Structural framing of reinforced concrete around elevators and stairways shall be accurately plumbed and located within 1/4 in. tolerance from established dimensions.

C. The Contractor shall establish and maintain in an undisturbed condition and until final completion and acceptance of the project, sufficient control points and benchmarks to be used for reference purposes to check tolerances. Plumb and string lines shall be installed before concrete placement and shall be maintained during placement. Such lines shall be used by Contractor's personnel and by the Engineer and shall be in sufficient number and properly installed. During concrete placement, the Contractor shall continually monitor plumb and string line form positions and immediately correct deficiencies.

D. Regardless of the tolerances specified, no portion of the structure shall extend beyond the legal boundary of the structure.

3.04 FORM ACCESSORIES

A. Suitable moldings shall be placed to bevel or round all exposed corners and edges of beams, columns, walls, slabs, and equipment pads. Chamfers shall be 3/4 inch unless otherwise noted.

B. Form ties shall be so constructed that the ends, or end fasteners, can be removed without causing appreciable spalling at the faces of the concrete. After ends, or end fasteners of form ties have been removed, the embedded portion of the ties shall terminate not less than 2 inches from the formed face of the concrete that is exposed to water or enclosed surfaces above the water surface, and not less than 1 inch from the formed face of all other concrete. Holes left by the removal of form tie cones shall be reamed with suitable toothed reamers to leave the surface of the holes clean and rough before being filled with mortar as specified in Section 03 35 00 – Concrete Finishes. No form-tying device or part thereof, other than metal, shall be left embedded in the concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete member. The use of snap-ties which cause spalling of the concrete upon form stripping or tie removal will not be permitted. No snap ties

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shall be broken off until the concrete is at least three days old. If steel panel forms are used, rubber grommets shall be provided where the ties pass through the form in order to prevent loss of cement paste.

3.05 APPLICATION – FORM RELEASE AGENT

A. Forms for concrete surfaces that will not be subsequently waterproofed shall be coated with a form release agent. Form release agent shall be applied on formwork in accordance with manufacturer's recommendations.

3.06 INSERTS AND EMBEDDED ITEMS

A. Sleeves, pipe stubs, inserts, anchors, expansion joint material, waterstops, and other embedded items shall be positioned accurately and supported against displacement prior to concreting. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable material to prevent the entry of concrete into the voids.

3.07 FORM CLEANING AND REUSE

A. The inner faces of all forms shall be thoroughly cleaned prior to concreting. Forms may be reused only if in good condition and only if acceptable to the Engineer. Light sanding between uses will be required wherever necessary to obtain uniform surface texture. Unused tie rod holes in forms shall be covered with metal caps or shall be filled by other methods acceptable to the Engineer.

3.08 FORM REMOVAL AND SHORING

A. Forms shall not be disturbed until the concrete has attained sufficient strength. Sufficient strength shall be demonstrated by structural analysis considering proposed loads, strength of forming and shoring system, and concrete strength data. Shoring shall not be removed until the supported member has acquired sufficient strength to support its weight and the load upon it. Members subject to additional loads during construction shall be adequately shored to sustain all resulting stresses. Forms shall be removed in such manner as not to impair safety and serviceability of the structure. All concrete to be exposed by form removal shall have sufficient strength not to be damaged thereby.

B. Provided the strength requirements specified above have been met and subject to the Engineer's approval, forms may be removed at the following minimum times. The Contractor shall assume full responsibility for the strength of all such components from which forms are removed prior to the concrete attaining its full design compressive strength. Shoring may be required at the option of the Engineer beyond these periods.

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Ambient Temperature (°F.) During Concrete Placement					
	Over 95°	**70°-95°**	**60°-70°**	**50°-60°**	**Below 50°**
Edge Forms for Slabs on Grade	1 day	1 day	1 day	1 day	
Walls	5 days	2 days	2 days	3 days	Do not remove until directed by Engineer (7 days minimum)
Columns	7 days	2 days	3 days	4 days	
Beam Soffits	10 days	7 days	7 days	7 days	
Elevated Slabs	12 days	7 days	7 days	7 days	

C. When, in the opinion of the Engineer, conditions of the work or weather justify, forms may be required to remain in place for longer periods of time.

D. An accurate record shall be maintained by the Contractor of the dates of concrete placings and the exact location thereof and the dates of removal of forms. These records shall always be available for inspection at the site, and two copies shall be furnished the Engineer upon completion of the concrete work.

3.09 RESHORING

A. When reshoring is permitted or required the operations shall be planned and subjected to approval by the Engineer.

B. Reshores shall be placed after stripping operations are complete but in no case later than the end of the working day on which stripping occurs.

C. Reshoring for the purpose of early form removal shall be performed so that at no time will large areas of new construction be required to support their own weight. While reshoring is under way, no construction or live loads shall be permitted on the new construction. Reshores shall be tightened to carry their required loads but they shall not be overtightened so that the new construction is overstressed. Reshores shall remain in place until the concrete has reached its specified 28-day strength, unless otherwise specified.

D. For floors supporting shores under newly placed concrete, the original supporting shores shall remain in place or reshores shall be placed. The shoring or reshoring system shall have a capacity sufficient to resist the anticipated loads and, in all cases, shall have a capacity equal to at least one-half of the capacity of the shoring system above. Reshores shall be located directly under a reshore position above unless other locations are permitted.

E. In multi-story buildings, reshoring shall extend over a sufficient number of stories to distribute the weight of newly placed concrete, forms, and construction live loads so the design superimposed loads of the floors supporting shores are not exceeded.

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END OF SECTION

SECTION 03 15 00

CONCRETE ACCESSORIES

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Furnish all materials, labor and equipment required to provide all concrete accessories including waterstops, expansion joint material, joint sealants, expansion joint seals, crack inducing joint inserts, epoxy bonding agent, and neoprene bearing pads.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03 11 00 – Concrete Formwork

B. Section 03 15 16 – Joints in Concrete

C. Section 03 30 00 – Cast-in-Place Concrete

D. Section 07 90 00 – Joint Fillers, Sealants, and Caulking

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. ASTM C881 – Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete

2. ASTM D412 – Standard Tests for Rubber Properties in Tension

3. ASTM D 624 – Standard Test method for Rubber Property - Tear Resistance

4. ASTM D 638 – Standard Test Method for Tensile Properties of Plastics

5. ASTM D1751 – Standard Specifications for Preformed Expansion Joint fillers for Concrete Paving and Structural Construction (non-extruding and resilient bituminous types)

6. ASTM D 1752 – Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

7. ASTM D 1171 – Standard Test Method for Ozone Resistance at 500 pphm

8. ASTM D 471 – Standard Test Method for Rubber Properties

9. ASTM D 2240 – Standard Test for Rubber Property – Durometer Hardness

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1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures.

1. Manufacturer's literature on all products specified herein including material certifications.

2. Proposed system for supporting PVC waterstops in position during concrete placement.

3. Samples of products if requested by the Engineer.

PART 2 – PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) WATERSTOPS

A. PVC waterstops for construction joints shall be flat ribbed type, 6 inches wide with a minimum thickness at any point of 3/8 inches.

B. Waterstops for expansion joints shall be ribbed with a center bulb. They shall be 9 inches wide with a minimum thickness at any point of 3/8 inch unless shown or specified otherwise. The center bulb shall have a minimum outside diameter of 1 inch and a minimum inside diameter of 1/2 inch.

C. The waterstops shall be manufactured from virgin polyvinyl chloride plastic compound and shall not contain any scrap or reclaimed material or pigment whatsoever. The properties of the polyvinyl chloride compound used, as well as the physical properties of the waterstops, shall exceed the requirements of the U.S. Army Corps. of Engineers' Specification CRD-C572. The waterstop material shall have an off-white, milky color.

D. The required minimum physical characteristics for this material are:

1. Tensile strength – 1,750 psi (ASTM D-638).

2. Ultimate elongation – not less than 280% (ASTM D-638).

E. No reclaimed PVC shall be used for the manufacturing of the waterstops. The Contractor shall furnish certification that the proposed waterstops meet the above requirements.

F. PVC waterstops shall be as manufactured by:

1. BoMetals, Inc.,

2. DuraJoint Concrete Accessories,

3. Sika Greenstreak,

4. Or approved equal.

G. All waterstop intersections, both vertical and horizontal, shall be made from factory fabricated corners and transitions. Only straight butt joint splices shall be made in field.

2.02 RETROFIT WATERSTOPS

A. Retrofit waterstops shall be used where specifically shown on Drawings for sealing joints between existing concrete construction and new construction.

B. Retrofit waterstops shall be PVC waterstops fabricated from material as described in Section 2.01 of this Section.

C. Retrofit waterstop shall be attached to existing concrete surface as shown on Drawings.

D. Use of split waterstop in lieu of specially fabricated retrofit waterstop will not be acceptable.

E. Retrofit Waterstop manufacturer must provide a complete system including all Waterstop, stainless steel anchoring hardware, and epoxy for installation.

F. For construction joints, retrofit waterstop shall be:

1. Style number 609 by Sika Greenstreak;

2. RF-638 by BoMetals, Inc.,

3. Or approved equal.

G. For expansion joints, retrofit waterstop shall be:

1. Style number 667 by Sika Greenstreak;

2. RF-912 by BoMetals, Inc.;

3. Type 36RT Retrofit Kit by DuraJoint Concrete Accessories;

4. Or approved equal.

2.03 WATERPROOF MEMBRANE PATCH

A. Waterproof membrane patch shall be:

1. Sikadur Combiflex by Sika Corporation;

2. Or approved equal.

B. Minimum width of waterstop material shall be twelve (12) inches unless shown otherwise on Contract Drawings.

2.04 HYDROPHILIC WATERSTOPS

A. Hydrophilic waterstops shall be designed to expand under hydrostatic conditions.

1. For hydrostatic head pressure greater than 25 feet, waterstops shall be:

a. Adeka Ultra Seal MC-2010MN by Adeka Ultra Seal/OCM, Inc.;

b. Hydrotite CJ-1020-2K by Sika Greenstreak;

c. Or approved equal.

2. For hydrostatic head pressure 25 feet or less, waterstops shall be:

a. Adeka Ultra Seal KBA-1510FP by Adeka Ultra Seal/OCM, Inc.;

b. Hydrotite CJ-1020-2K by Sika Greenstreak;

c. Or approved equal.

3. Concrete cover and confinement requirements shall be in accordance with the manufacturer’s recommendations.

B. Waterstops shall be fabricated from a chemically modified natural rubber product with a hydrophilic agent. Use of bentonite based waterstop material will not be allowed.

C. Waterstops shall either contain an interior stainless-steel mesh or an interior coextrusion of non-hydrophilic rubber to ensure expansion occurs along the width and thickness of the waterstop thereby restricting the expansion in the longitudinal direction.

2.05 WATERSTOP ADHESIVE

A. Adhesive between waterstops and existing concrete shall be:

1. Neoprene Adhesive 77-198 by JGF Adhesives;

2. Sikadur 31 Hi-Mod Gel by Sika Corporation;

3. DP-605 NS Urethane Adhesive by 3M Adhesive Systems;

4. Or approved equal.

B. Hydrophilic, non-bentonite water swelling elastic sealant shall be used to bond hydrophilic waterstops to rough surfaces. Hydrophilic elastic sealant shall be:

1. P-201 by Adeka Ultra Seal/OCM, Inc.;
2. Leakmaster LV-Z by Sika Greenstreak;
3. Or approved equal.

2.06 JOINT SEALANTS

A. Joint sealants shall comply with Section 07 90 00 – Joint Fillers, Sealants, and Caulking.

2.07 EXPANSION JOINT MATERIAL

A. Preformed expansion joint material shall be non-extruding, and shall be of the following types:

1. Type I – Sponge rubber, conforming to ASTM D1752, Type I.
2. Type II –Cork, conforming to ASTM D1752, Type II.
3. Type III – Self-expanding cork, conforming to ASTM D1752, Type III.
4. Type IV – Bituminous fiber, conforming to ASTM Designation D1751.

2.08 EXPANSION JOINT SEAL

A. Expansion Joint Seal System shall consist of a preformed neoprene profile, installed using the same dimensions as the joint gap, bonded with a two-component epoxy adhesive, and pressurized during the adhesive cure time.

B. The expansion joint system shall be:

1. Hydrozo/Jeene Structural Sealing joint system by Hydrozo/Jeene, Inc.;
2. Or approved equal.

2.09 NOT USED

2.10 EPOXY BONDING AGENT

A. Epoxy bonding agent shall conform to ASTM C881 and shall be:

1. Sikadur 32 Hi-Mod, by Sika Corporation;
2. Euco #452 Epoxy System, by Euclid Chemical Company;
3. MasterEmaco ADH Series by Master Builders Solutions;
4. Or approved equal.

2.11 EPOXY RESIN BINDER

A. Epoxy resin binder shall conform to the requirements of ASTM C-881, Type III, Grade 3, Class B and C for epoxy resin binder and shall be:

1. Sikadur 23, Low-Mod-Gel by Sika Corporation;

2. Flexocrete Gel by DuraJoint Concrete Accessories;

3. Euco #352 Gel by Euclid Chemical Company;

4. MasterEmaco ADH 327 or 327 RS by Master Builders Solutions;

5. Or approved equal.

2.12 BEARING PADS

A. Neoprene bearing pads shall conform to requirements of A4-F3-T.063-B2, Grade 2, Method B, in accordance with the RMA Rubber Handbook. Pads shall be nonlaminated pads having a nominal Shore A durometer hardness of 70 in accordance with ASTM D2240. Adhesive for use with neoprene pads shall be an epoxy-resin compound compatible with the neoprene having a sufficient shear strength to prevent slippage between pads and adjacent bearing surfaces. Adhesive shall be:

1. 20+F Contact Cement by Miracle Adhesives Corporation;

2. Neoprene Adhesive 77-198 by IGI Adhesives;

3. Sikadur 31, Hi-Mod Gel by Sika Corporation;

4. DP-605 NS Urethane Adhesive by 3M Adhesive Systems;

5. Or approved equal.

PART 3 – EXECUTION

3.01 PVC AND CHEMICAL RESISTANT WATERSTOPS

A. PVC and chemical resistant waterstops shall be provided in all construction and expansion joints in water bearing structures and at other such locations as required by the Drawings.

B. Waterstops shall be carefully positioned so that they are embedded to an equal depth in concrete on both sides of the joint. They shall be kept free from oil, grease, mortar or other foreign matter. To ensure proper placement, all waterstops shall be secured in correct position at 12" on center along the length of the waterstop on each side, prior to placing concrete. Such method of support shall be submitted to the Engineer for review

and approval. Grommets or small pre-punched holes as close to the edges as possible will be acceptable for securing waterstops.

C. Splices in PVC waterstops and chemical resistant waterstops shall be made with a thermostatically controlled heating element. Only straight butt joint splices will be allowed in the field. Factory fabricated corners and transitions shall be used at all intersections. Splices shall be made in strict accordance with the manufacturer's recommended instructions and procedures. At least three satisfactory sample splices shall be made on the site. The Engineer may require tests on these splices by an approved laboratory. The splices shall exhibit not less than 80 percent of the strength of the unspliced material.

D. All splices in waterstops will be subject to rigid review for misalignment, bubbles, inadequate bond, porosity, cracks, offsets, discoloration, charring, and other defects which would reduce the potential resistance of the material to water pressure at any point. All defective joints shall be replaced with material which will pass said review and all faulty material shall be removed from the site and disposed of by the Contractor at no additional cost to the Owner.

E. Retrofit waterstops shall be installed as shown on Contract Drawings using approved waterstop adhesive and Type 316 stainless steel batten bars and expansion anchors.

F. Waterstop installation and splicing defects which are unacceptable include, but are not limited to the following:

1. Tensile strength less than 80 percent of parent material.

2. Overlapped (not spliced) Waterstop.

3. Misalignment of waterstop geometry at any point greater than 1/16 inch.

4. Visible porosity or charred or burnt material in weld area.

5. Visible signs of splice separation when splice (24 hours or greater) is bent by hand at sharp angle.

3.02 WATERPROOF MEMBRANE PATCH AND HYDROPHILIC WATERSTOPS

A. Patches and waterstops shall be installed only where shown on the Drawings.

B. Patches and waterstops shall be installed in strict accordance with manufacturer's recommendations.

3.03 WATERSTOP ADHESIVE

A. Adhesive shall be applied to both contact surfaces in strict accordance with manufacturer's recommendations.

B. Adhesive shall be used where waterstops are attached to existing concrete surfaces.

3.04 INSTALLATION OF EXPANSION JOINT MATERIAL AND SEALANTS

A. Type I, II, or III shall be used in all expansion joints in structures and concrete pavements unless specifically shown otherwise on the Drawings. Type IV shall be used in sidewalk and curbing and other locations specifically shown on the Drawings.

B. All expansion joints exposed in the finish work, exterior and interior, shall be sealed with the specified joint sealant. Expansion joint material and sealants shall be installed in accordance with manufacturer's recommended procedures and as shown on the Drawings.

C. Expansion joint material that will be exposed after removal of forms shall be cut and trimmed to ensure a neat appearance and shall completely fill the joint except for the space required for the sealant. The material shall be held securely in place and no concrete shall be allowed to enter the joint or the space for the sealant and destroy the proper functions of the joint.

D. A bond breaker shall be used between expansion joint material and sealant. The joint shall be thoroughly clean and free from dirt and debris before the primer and the sealant are applied. Where the finished joint will be visible, masking of the adjoining surfaces shall be carried out to avoid their discoloration. The sealant shall be neatly tooled into place and its finished surfaces shall present a clean and even appearance.

E. Type 1 joint sealant shall be used in all expansion and crack inducing joints in concrete, except where other specific types are required as stated below, and wherever else specified or shown on the Drawings. Sealant shall be furnished in pour grade or gun grade depending on installation requirements. Primers shall be used as required by the manufacturer. The sealant shall be furnished in colors as directed by the Engineer.

F. Type 8 joint sealant shall be used in all concrete pavements and floors subject to heavy traffic and wherever else specified or shown on the Drawings.

3.05 EXPANSION JOINT SEAL

A. The expansion joint seal system shall be installed as shown on the Drawings in strict accordance with the manufacturer's recommendations.

3.06 EPOXY BONDING AGENT

A. The Contractor shall use an epoxy bonding agent for bonding fresh concrete to existing concrete as shown on the Drawings.

B. Bonding surface shall be clean, sound, and free of all dust, laitance, grease, form release agents, curing compounds, and any other foreign particles.

C. Application of bonding agent shall be in strict accordance with manufacturer's recommendations.

D. Fresh concrete shall not be placed against existing concrete if epoxy bonding agent has lost its tackiness.

3.07 EPOXY RESIN BINDER

A. Epoxy resin binder shall be used to seal all existing rebar cut and burned off during demolition operations. Exposed rebar shall be burned back 1/2-inch minimum into existing concrete and the resulting void filled with epoxy resin binder.

3.08 BEARING PADS

A. Care shall be taken in fabricating pads and related metal parts so effects detrimental to the proper performance of the pads, such as uneven bearing and excessive bulging, will not occur.

END OF SECTION

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SECTION 03 15 16

JOINTS IN CONCRETE

PART 1 – GENERAL

1.01 THE REQUIREMENTS

A. Provide all materials, labor and equipment required for the construction of all joints in concrete specified herein and shown on the Drawings.

B. Types of joints in concrete shall be defined as follows:

1. Construction Joints – Intentionally created formed joints between adjacent concrete placements with 100% of reinforcement continuous through joint.

2. Expansion Joints – Formed joints in concrete which separate adjacent sections to allow movement due to dimensional increases and reduction of adjacent sections (temperature and shrinkage). Reinforcement terminates within concrete on each side of joint. Expansion joints may also be considered isolation joints.

3. Contraction Joints – Formed joints in concrete to create interface between concrete placements to allow movement due to dimensional reduction of adjacent sections (shrinkage).

    a. Full Contraction Joints – Formed contraction joints with no bonded reinforcement passing through the joint.

    b. Partial Contraction Joints – Formed contraction joints with no more than 50% of bonded reinforcement passing through the joint.

4. Crack Inducing Joints – Joints formed, tooled, or sawcut in a monolithic placement to create a weakened plane to regulate the location of crack formation due to dimensional reduction of adjacent sections (shrinkage).

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03 11 00 – Concrete Formwork

B. Section 03 15 00 – Concrete Accessories

C. Section 03 30 00 – Cast-in-Place Concrete

D. Section 03 39 00 – Concrete Curing

E. Section 07 90 00 – Joint Fillers, Sealants and Caulking

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. ACI 301 – Specifications for Structural Concrete for Buildings
2. ACI 318 – Building Code Requirements for Structural Concrete
3. ACI 350 – Code Requirements for Environmental Engineering Concrete Structures
4. ACI 224.3 – Joints in Concrete Construction

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures.

1. Layout drawings showing location and type of all joints to be placed in each structure.
2. Details of proposed joints in each structure.
3. For sawcut crack-inducing joints, submit documentation indicating the following:
    a. Proposed method of sawcutting indicating early entry or conventional sawing.
    b. Description of how work is to be performed including equipment to be utilized, size of crew performing the work and curing methods.
    c. Description of alternate method in case of time constraint issues or failure of equipment.

PART 2 – MATERIALS

2.01 MATERIALS

A. All materials required for joint construction shall comply with Section 03 15 00 – Concrete Accessories and Section 07 90 00 – Joint Fillers, Sealants and Caulking.

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PART 3 – EXECUTION

3.01 CONSTRUCTION JOINTS

A. Construction joints shall be as shown on the Drawings. Otherwise, Contractor shall submit description of the joint and proposed location to Engineer for approval. All joints shall be construction joints or expansion joints unless otherwise specified on the Drawings or approved by the Engineer on the joint plan submittal.

B. Unless noted otherwise on the Drawings, construction joints shall be located near the middle of the spans of slabs, beams, and girders unless a beam intersects a girder at this point. In this case, the joints in the girders shall be offset a distance equal to twice the width of the beam. Joints in walls and columns shall be at the underside of floors, slabs, beams, or girders and the top of footings or floor slabs unless noted otherwise on Drawings. Beams, girders, brackets, column capitals, haunches, and drop panels shall be placed at the same time as slabs. Joints shall be perpendicular to the main reinforcement.

C. Maximum distance between horizontal joints in slabs and vertical joints in walls shall be 50’-0”. For exposed walls with fluid or earth on the opposite side, the spacing between vertical and horizontal joints shall be a maximum of 25’-0”.

D. All corners shall be part of a continuous placement, and should a construction joint be required, the joint shall not be located closer than five feet from a corner.

E. All reinforcing steel and welded wire fabric shall be continued across construction joints. Keys and inclined dowels shall be provided as shown on the Drawings or as directed by the Engineer. Longitudinal keys shall be provided in all joints in walls and between walls and slabs or footings, except as specifically noted otherwise on the Drawings. Size of keys shall be as shown on the Drawings.

F. All joints in water bearing structures shall have a waterstop. All joints below grade in walls or slabs which enclose an accessible area shall have a waterstop.

G. Joint plan of walls and slabs shall consider aspect ratio to create placement of sections as close to square as possible. Aspect ratio is defined as the ratio of plan dimensions for slab sections and length to height placement of wall sections. Aspect ratios shall be between 0.65 and 1.5.

3.02 EXPANSION JOINTS

A. Size and location of expansion joints shall be as shown on the Drawings. All joints shall be construction joints or expansion joints unless otherwise specified on the Drawings or approved by the Engineer on the joint plan submittal.

B. All expansion joints in water-bearing structures shall have a center-bulb type waterstop. All expansion joints below grade in walls or slabs which enclose an accessible area shall

have a center-bulb type waterstop. Waterstop shall be as shown on Drawings and specified in Section 03 15 00 – Concrete Accessories.

3.03 CONTRACTION JOINTS

A. Contraction joints shall be located as shown on the Drawings or otherwise approved by the Engineer on the joint plan submittal. Contractor shall submit proposed locations and details of all contraction joints concurrent or prior to submission of reinforcement drawings. Use of contraction joints at locations not specifically detailed on the Drawings requires Engineer approval and will only be considered if meeting the stipulations herein.

B. Full contraction joints may be considered where the structural behavior of the element allows termination of all reinforcement through joint without compromise of structural integrity of element.

C. Partial contraction joints may be considered where the structural behavior of the element requires partial continuation of reinforcement through joint to ensure structural integrity.

D. Where full contraction joints are allowed, maximum distance between horizontal contraction joints in slab and vertical contraction joints in walls shall be 50’-0”. For exposed walls with fluid or earth on the opposite side, spacing between vertical and horizontal contraction joints shall be a maximum of 25’-0”.

E. Bond breaker shall be provided between sections for all contraction joints.

F. Joint plan of walls and slabs shall consider aspect ratio to create placement of sections as close to square as possible. Aspect ratio is defined as the ratio of plan dimensions for slab sections and length to height placement of wall sections. Aspect ratios shall be between 0.65 and 1.5.

3.04 CRACK INDUCING JOINTS

A. Location of crack inducing joints shall be as shown on the Drawings or submitted by Contractor and approved by Engineer.

B. Crack inducing joints shall be formed either by saw cutting, tooling, or use of approved inserts as specified in Section 03 15 00 – Concrete Accessories.

C. If approved by the Engineer, saw cutting of contraction joints in lieu of forming or tooling shall conform to the following requirements:

1. Joints shall be sawed as soon as the concrete can support foot traffic without leaving any impression, normally the same day as concrete is placed and in no case longer than 24 hours after concrete is placed.

2. Curing shall be performed using wet curing methods as indicated in Section 03 39 00 – Concrete Curing. Curing mats, fabrics or sheeting materials shall remain in

place to the extent possible while cutting of joint is being performed. Curing materials shall only be removed as required and shall be immediately reinstalled once cutting of the joint has been completed.

3. Depth of joint shall be as shown on the drawings or noted in these specifications. At locations where the joint cannot be installed to full depth due to curbs or other stopping points hand tools shall be used to complete joints.

4. Saw cut joints shall meet the requirements of ACI 224.3, Section 2.8, Jointing Practice.

D. Unless noted otherwise on Drawings, depth of crack inducing joints shall be 1-1/2 inches in reinforced concrete and 1/3 of concrete thickness in unreinforced concrete.

3.05 JOINT PREPARATION

A. No concrete shall be allowed to enter the joint or the space for the sealant and destroy the proper functions of the joint.

B. The surface of the concrete at all joints shall be thoroughly cleaned and all laitance removed by wire brushing, air or light sand blasting.

C. The joint shall be thoroughly clean and free from dirt and debris before the primer and the sealant are applied. Where the finished joint will be visible, masking of the adjoining surfaces shall be carried out to avoid their discoloration. The sealant shall be neatly tooled into place and its finished surface shall present a clean and even appearance.

D. All joints shall be sealed as shown on the Drawings and specified in Section 03 15 00 – Concrete Accessories.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 03 21 00

REINFORCING STEEL

PART 1 – GENERAL

1.01 THE REQUIREMENTS

A. Provide all concrete reinforcing including all cutting, bending, fastening and any special work necessary to hold the reinforcing steel in place and protect it from injury and corrosion in accordance with the requirements of this Section.

B. Provide deformed reinforcing bars to be grouted into reinforced concrete masonry walls.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 45 33 – Special Inspections

B. Section 03 11 00 – Concrete Formwork

C. Section 03 15 00 – Concrete Accessories

D. Section 03 30 00 – Cast-in-Place Concrete

E. Section 04 22 23.23 – Prefaced Concrete Unit Masonry

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. New York State Building Code.

2. CRSI - Concrete Reinforcing Institute Manual of Standard Practice

3. ACI SP66 - ACI Detailing Manual

4. ACI 315 - Details and Detailing of Concrete Reinforcing

5. ACI 318 - Building Code Requirements for Structural Concrete

6. WRI - Manual of Standard Practice for Welded Wire Fabric

7. ASTM A 615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

8. ASTM A 1064 - Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

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9. ASTM E 3121 – Standard Test Methods for Field Testing of Anchors in Concrete or Masonry

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures.

1. Detailed placing and shop fabricating drawings, prepared in accordance with ACI 315 and ACI Detailing Manual - (SP66), shall be furnished for all concrete reinforcing. These drawings shall be made to such a scale as to clearly show joint locations, openings, and the arrangement, spacing and splicing of the bars.

2. Detailed placing and shop fabricating drawings, prepared in accordance with ACI 315 and ACI Detailing Manual - (SP66), shall be furnished for all deformed bar reinforcing used in masonry. These drawings shall be made to such a scale as to clearly show joint locations, openings, and the arrangement, locations, spacing and splicing of the bars.

3. Mill test certificates - 3 copies of each.

4. Description of the reinforcing steel manufacturer's marking pattern.

5. Requests to relocate any bars that cause interferences or that cause placing tolerances to be violated.

6. Proposed supports for each type of reinforcing.

7. Request to use splices not shown on the Drawings.

8. Request to use mechanical couplers along with manufacturer's literature on mechanical couplers with instructions for installation, and certified test reports on the couplers' capacity.

9. Request for placement of column dowels without the use of templates.

10. Request and procedure to field bend or straighten partially embedded reinforcing.

11. International Code Council–Evaluation Services Report (ICC-ES ESR) for dowel adhesives.

12. Certification that all installers of dowel adhesive systems in horizontal to vertically overhead applications are certified as Adhesive Anchor Installers in accordance with the ACI-CRSI Anchor Installer Certification Program.

13. Adhesive dowel testing plan.

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1.05 QUALITY ASSURANCE

A. If requested by the Engineer, the Contractor shall provide samples from each load of reinforcing steel delivered in a quantity adequate for testing. Costs of initial tests will be paid by the Owner. Costs of additional tests due to material failing initial tests shall be paid by the Contractor.

B. Provide a list of names of all installers who are trained by the Manufacturer's Field Representative on this jobsite prior to installation of products. Record must include the installer name, date of training, products included in the training and trainer name and contact information.

C. Provide a copy of the current ACI/CRSI "Adhesive Anchor Installer" certification cards, or equivalent, for all installers who will be installing adhesive anchors in the horizontal to vertically overhead orientation.

D. Special inspections for adhesive dowels shall be conducted in accordance with the manufacturer's instructions and Specification Section 01 45 33 – Special Inspections. Downward installations require periodic inspection and horizontal and overhead installations require continuous inspection.

PART 2 – PRODUCTS

2.01 REINFORCING STEEL

A. Bar reinforcing shall conform to the requirements of ASTM A 615 for Grade 60 deformed billet-steel reinforcing. All reinforcing steel shall be from domestic mills and shall have the manufacturer's mill marking rolled into the bar which shall indicate the producer, size, type, and grade. All reinforcing bars shall be deformed bars. Smooth reinforcing bars shall not be used unless specifically called for on Drawings.

B. Welded wire fabric reinforcing shall conform to the requirements of ASTM A 1064 and the details shown on the Drawings.

C. A certified copy of the mill test on each load of reinforcing steel delivered showing physical and chemical analysis shall be provided, prior to shipment. The Engineer reserves the right to require the Contractor to obtain separate test results from an independent testing laboratory in the event of any questionable steel. When such tests are necessary because of failure to comply with this Section, such as improper identification, the cost of such tests shall be borne by the Contractor.

D. Field welding of reinforcing steel will not be allowed.

E. Use of coiled reinforcing steel will not be allowed.

2.02 ACCESSORIES

A. Accessories shall include all necessary chairs, slab bolsters, concrete blocks, tie wires, dips, supports, spacers, and other devices to position reinforcing during concrete placement. Wire bar supports shall be plastic protected (CRSI Class 1).

B. Concrete blocks (dobies), used to support and position bottom reinforcing steel, shall have the same or higher compressive strength as specified for the concrete in which it is located.

2.03 MECHANICAL COUPLERS

A. Mechanical couplers shall develop a tensile strength which exceeds 100 percent of the ultimate tensile strength and 125 percent of the yield strength of the reinforcing bars being spliced. The reinforcing steel and coupler used shall be compatible for obtaining the required strength of the connection.

B. Where the type of coupler used is composed of more than one component, all components required for a complete splice shall be supplied.

C. Hot forged sleeve type couplers shall not be used.

1. Acceptable mechanical couplers are:

   a. Dayton Superior Dowel Bar Splicer System by Dayton Superior,

   b. Or approved equal.

2. Mechanical couplers shall only be used where shown on the Drawings or where specifically approved by the Engineer.

D. Where the threaded rebar to be inserted into the coupler reduces the diameter of the bar, the threaded rebar piece shall be provided by the coupler manufacturer.

2.04 DOWEL ADHESIVE SYSTEM

A. Where shown on the Drawings, reinforcing bars anchored into hardened concrete with a dowel adhesive system shall use a two-component adhesive mix which shall be injected with a static mixing nozzle following manufacturer's instructions.

B. All holes shall be drilled in accordance with the manufacturer’s instructions except that core drilled holes shall not be permitted unless specifically allowed by the Engineer. Cored holes, if allowed by the manufacturer and approved by the Engineer, shall be roughened in accordance with manufacturer’s requirements.

C. Thoroughly clean drill holes of all debris, drill dust, and water in accordance with manufacturer’s instructions prior to installation of adhesive and reinforcing bar.

D. Degree of hole dampness shall be in strict accordance with manufacturer recommendations. Installation conditions shall be dry, or water saturated unless otherwise permitted by the engineer. If water saturated installation is approved, appropriate reduction factors in accordance with manufacturer's design requirements should be considered. Water filled or submerged holes shall not be permitted unless specifically approved by the Engineer.

E. Injection of adhesive into the hole shall be performed in a manner to minimize the formation of air pockets in accordance with the manufacturer's instructions.

F. Embedment Depth:

1. The embedment depth of the bar shall be as shown on the Drawings. Although all manufacturers listed below are permitted, the embedment depth shown on the Drawings is based on "HIT-HY 200 by Hilti, Inc". If the Contractor submits one of the other named dowel adhesives from the list below, the Engineer shall evaluate the required embedment and the Contractor shall provide the required embedment depth stipulated by the Engineer specific to the approved dowel adhesive.

2. Where the embedment depth is not shown on the Drawings, the embedment depth shall be determined to provide the minimum allowable bond strength equal to the tensile strength of the rebar according to the manufacturer's ICC-ES ESR.

3. The embedment depth shall be determined using design parameters listed below. In no case shall the embedment depth be less than the minimum, or more than the maximum, embedment depths stated in the manufacturer's ICC-ES ESR.

4. Design of adhesive anchor system shall be based on the following parameters:

    a. Actual compressive strength of concrete.

    b. Cracked concrete state.

    c. Dry or water saturated condition for installation.

    d. Base material temperature between 40- and 104-degrees Fahrenheit.

    e. Installation with either a hammer drill with carbide bit or hollow-drill bit system drilling methods.

    f. Minimum age of concrete 21 days at time of installation.

G. Engineer's approval is required for use of this system in locations other than those shown on the Drawings.

H. The adhesive system shall be IBC compliant for use in both cracked and uncracked concrete in all Seismic Design Categories.

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1. The adhesive system shall be:

    a. "HIT-HY 200 Adhesive Anchoring System" by Hilti, Inc.;

    b. “SET-3G Epoxy Adhesive Anchors” by Simpson Strong-Tie Co.;

    c. “Pure 110+ Epoxy Adhesive Anchor System” by DeWal;

    d. Or approved equal.

2. Fast-set epoxy formulations shall not be acceptable.

I. All individuals installing dowel adhesive systems in horizontal to vertically overhead applications shall be certified as an Adhesive Anchor Installer in accordance with the ACI-CRSI Anchor Installation Certification Program, or equivalent.

PART 3 – EXECUTION

3.01 FABRICATION

A. Reinforcing steel shall be accurately formed to the dimensions and shapes shown on the Drawings and the fabricating details shall be prepared in accordance with ACI 315 and ACI 318, except as modified by the Drawings.

B. The Contractor shall fabricate reinforcing bars for structures in accordance with the bending diagrams, placing lists and placing Drawings.

C. No fabrication shall commence until approval of Shop Drawings has been obtained. All reinforcing bars shall be shop fabricated unless approved to be bent in the field. Reinforcing bars shall not be straightened or bent in a manner that will injure the material. Heating of bars will not be permitted.

D. Welded wire fabric with longitudinal wire of W9.5 size or smaller shall be either furnished in flat sheets or in rolls with a core diameter of not less than 10 inches. Welded wire fabric with longitudinal wires larger than W9.5 size shall be furnished in flat sheets only.

3.02 DELIVERY, STORAGE AND HANDLING

A. All reinforcing shall be neatly bundled and tagged for placement when delivered to the job site. Bundles shall be properly identified for coordination with mill test reports.

B. Reinforcing steel shall be stored above ground on platforms or other supports and shall always be protected from the weather by suitable covering. Reinforcing steel shall be stored in an orderly manner and plainly marked to facilitate identification.

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C. Reinforcing steel shall always be protected from conditions conducive to corrosion until concrete is placed around it.

D. The surfaces of all reinforcing steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar and other foreign substances immediately before the concrete is placed. Where delay in depositing concrete occurs, reinforcing shall be inspected again and if necessary recleaned.

3.03 PLACING

A. Reinforcing steel shall be accurately positioned as shown on the Drawings and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections. All reinforcing steel shall be supported by concrete, plastic or plastic protected (CRSI Class 1) metal supports, spacers or metal hangers which are strong and rigid enough to prevent any displacement of the reinforcing steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used in sufficient numbers to support the reinforcing bars without settlement. In no case shall concrete block supports be continuous.

B. The portions of all accessories in contact with the formwork shall be made of plastic or steel coated with a 1/8-inch minimum thickness of plastic which extends at least 1/2 inch from the concrete surface. Plastic shall be gray in color.

C. Tie wires shall be bent away from the forms to provide the specified concrete coverage.

D. Reinforcing bars additional to those shown on the Drawings, which may be found necessary or desirable by the Contractor for the purpose of securing reinforcing in position, shall be provided by the Contractor at no additional cost to the Owner.

E. Reinforcing placing, spacing, and protection tolerances shall be within the limits specified in ACI 318 except where in conflict with the Building Code, unless otherwise specified.

F. Reinforcing bars may be moved within one bar diameter as necessary to avoid interference with other concrete reinforcing, conduits, or embedded items. If bars are moved more than one bar diameter, or enough to exceed placing tolerances, the resulting arrangement of bars shall be as acceptable to the Engineer.

G. Welded wire fabric shall be supported on slab bolsters spaced not less than 30 inches on centers, extending continuously across the entire width of the reinforcing mat and supporting the reinforcing mat in the plane shown on the Drawings.

H. Reinforcing shall not be straightened or bent unless specifically shown on the drawings. Bars with kinks or bends not shown on the Drawings shall not be used. Coiled reinforcement shall not be used.

I. Dowel Adhesive System shall be installed in strict conformance with the manufacturer's recommendations and as required in Article 2.04 of this Section. A representative of the manufacturer must be on site prior to adhesive dowel installation to provide instruction on proper installation procedures for all adhesive dowel installers. Testing of adhesive dowels shall be as indicated below. If the dowels have a hook at the end to be embedded in subsequent work, an approved mechanical coupler shall be provided at a convenient distance from the face of existing concrete to facilitate adhesive dowel testing while maintaining required hook embedment in subsequent work.

J. All adhesive dowel installations in the horizontal or overhead orientation shall be conducted by a certified Adhesive Anchor Installer as certified by ACI/CSRI Adhesive Anchor Installer Certification program, or equivalent, per ACI 318-11 D.9.2.2 or ACI 318-14 17.8.2.2. Current AAI Certificates must be submitted to the Engineer for approval prior to commencement of any adhesive anchor installations.

K. Adhesive Dowel Testing

1. At all locations where adhesive dowels are shown on the Drawings, at least 10 percent of all adhesive dowels installed shall be tested to 80% of the yield load of the reinforcing bar, with a minimum of one tested dowel per group.

2. Contractor shall submit a plan and schedule indicating locations of dowels to be tested, load test values, and proposed dowel testing procedure (including a diagram of the testing equipment proposed for use) prior to conducting any testing. Proof testing procedures shall be in accordance with ASTM E 3121.

3. Where Contract Documents indicate adhesive dowel design is the Contractor's responsibility, the Contractor shall submit a plan and schedule indicating locations of dowels to be tested and load test values, sealed by a Professional Engineer currently registered in New York State. The Contractor shall also submit documentation indicating the Contractor's testing procedures have been reviewed and the proposed procedures are acceptable.

4. Adhesive Dowel shall have no visible indications of displacement or damage during or after the load test. Dowels exhibiting damage shall be removed and replaced. If more than 5 percent of tested dowels fail, then 100 percent of dowels shall be load tested.

5. Load testing of adhesive dowels shall be performed by an independent testing laboratory hired directly by the Contractor. The Contractor shall be responsible for costs of all testing, including additional testing required due to previously failed tests.

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3.04 SPLICING

A. Reinforcing bar splices shall only be used at locations shown on the Drawings. When necessary to splice reinforcing at points other than where shown, the splice shall be as acceptable to the Engineer.

B. The length of lap for reinforcing bars, unless otherwise shown on the Drawings shall be in accordance with ACI 318 for a class B splice.

C. Laps of welded wire fabric shall be in accordance with ACI 318. Adjoining sheets shall be securely tied together with No. 14 tie wire, one tie for each 2 running feet. Wires shall be staggered and tied in such a manner that they cannot slip.

D. Mechanical splices shall be used only where shown on the Drawings or when approved by the Engineer.

E. Couplers which are located at a joint face shall be a type which can be set either flush or recessed from the face as shown on the Drawings. The couplers shall be sealed during concrete placement to eliminate concrete, or cement paste from entering. After the concrete is placed, couplers intended for future connections shall be plugged and sealed to prevent any contact with water or other corrosive materials. Threaded couplers shall be plugged with plastic plugs which have an O-ring seal.

3.05 INSPECTION

A. The Contractor shall advise the Engineer of his intentions to place concrete and shall allow him adequate time to inspect all reinforcing steel before concrete is placed.

B. The Contractor shall advise the Engineer of his intentions to place grout in masonry walls and shall allow him adequate time to inspect all reinforcing steel before grout is placed.

3.06 CUTTING OF EMBEDDED REBAR

A. The Contractor shall not cut embedded rebar cast into structural concrete without prior approval.

END OF SECTION

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NO TEXT ON THIS PAGE

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Provide all labor, equipment, materials, and services necessary for the manufacture, transportation, and placement of all plain and reinforced concrete work, as shown on the Drawings or as required by the Engineer.

B. The requirements in this section shall apply to the following types of concrete:

1. Class A1 Concrete: Normal weight structural concrete to be used in all structures qualifying as environmental concrete structures designed in accordance with ACI 350 including pump stations, tanks, basins, process structures, and any structures containing fluid or process chemicals, or other materials used in treatment process.

2. Class A2 Concrete: Normal weight structural concrete in all structures other than environmental concrete structures as described above, and for all sidewalks and pavement.

3. Class A3 Concrete: Normal weight structural concrete to be used for interior slabs where a Type “D” Steel Troweled Finish or Type “G” Hardened Finish is required. Class A3 concrete shall not contain entrained air.

4. Class B Concrete: Normal weight structural concrete used for duct bank encasements, catch basins, fence and guard post embedment, concrete fill, and other areas where specifically noted on Contract Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03 11 00 – Concrete Formwork

B. Section 03 15 00 – Concrete Accessories

C. Section 03 15 16 – Joints in Concrete

D. Section 03 21 00 – Reinforcing Steel

E. Section 03 35 00 – Concrete Finishes

F. Section 03 39 00 – Concrete Curing

G. Section 03 60 00 – Grout

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1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the Specifications, all work herein shall conform to or exceed the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. New York State Building Code
2. ACI 214 – Guide to Evaluation of Strength Test Results of Concrete
3. ACI 301 – Specifications for Structural Concrete
4. ACI 304 – Guide for Measuring, Mixing, Transporting, and Placing Concrete
5. ACI 305 – Specification for Hot Weather Concreting
6. ACI 306 – Standard Specification for Cold Weather Concreting
7. ACI 309R – Guide for Consolidation of Concrete
8. ACI 318 – Building Code Requirements for Structural Concrete and Commentary
9. ACI 350 – Code Requirements for Environmental Engineering Concrete Structures
10. ASTM C 31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field
11. ASTM C 33 – Standard Specification for Concrete Aggregates
12. ASTM C 39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
13. ASTM C42 – Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
14. ASTM C 88 – Standard Test Method for Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate
15. ASTM C 94 – Standard Specification for Ready-Mixed Concrete
16. ASTM C 114 – Standard Test Method for Chemical Analysis of Hydraulic Cement
17. ASTM C 136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
18. ASTM C 138 – Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete

19. ASTM C 143 – Standard Test Method for Slump of Hydraulic Cement Concrete

20. ASTM C 150 – Standard Specification for Portland Cement

21. ASTM C 157 - Standard Test Method for Length Change of Hardened Hydraulic Cement, Mortar and Concrete

22. ASTM C 172 – Standard Practice for Sampling Freshly Mixed Concrete

23. ASTM C 192 – Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory

24. ASTM C 231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

25. ASTM C 260 – Standard Specification for Air-Entraining Admixtures for Concrete

26. ASTM C 295 – Standard Guide for Petrographic Examination of Aggregates for Concrete

27. ASTM C 457 – Standard Test Method for Microscopical Determination of the Air-Void System in Hardened Concrete

28. ASTM C 494 – Standard Specification for Chemical Admixtures for Concrete

29. ASTM C 595 – Standard Specification for Blended Hydraulic Cements

30. ASTM C 618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

31. ASTM C 989 – Standard Specification for Slag Cement for Use in Concrete and Mortars

32. ASTM C 1012 – Standard Test Method for Length Change of Hydraulic Cement Mortars Exposed to a Sulfate Solution

33. ASTM C 1077 – Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation

34. ASTM C 1157 – Standard Performance Specification for Hydraulic Cement

35. ASTM C 1260 – Test Method for Potential Alkali Reactivity of Aggregates (Mortar Bar Method)

36. ASTM C 1567 – Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)

37. ASTM C 1579 – Standard Test Method for Evaluating Plastic Shrinkage Cracking of Restrained Fiber Reinforced Concrete (Using a Steel Form Insert)

38. ASTM C 1602 – Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete

39. ASTM C 1609 – Standard Test Method for Flexural Performance of Fiber Reinforced Concrete (Using Beam with Third-Point Loading)

40. ASTM C 1778 – Standard Guide for Reducing the Risk of Deleterious Alkali – Aggregate Reaction in Concrete

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures.

1. Sources of all materials and certifications of compliance with specifications for all materials.

2. Certified current (less than 1 year old) chemical analysis (mill test report) of the Portland Cement or Blended Cement to be used. The chemical analysis must include the equivalent alkali content of the Portland Cement or Blended Cement.

3. Certified current (less than 1 year old) chemical analysis of fly ash or slag cement to be used.

4. Aggregate test results showing compliance with required standards, i.e., sieve analysis, potential reactivity, aggregate soundness tests, petrographic analysis, mortar bar expansion testing, etc.

5. Manufacturer's data on all admixtures stating compliance with required standards.

6. Concrete mix design for each class of concrete specified herein.

7. Verification concrete mix and individual constituents in concrete meet requirements for NSF 61 approval for potable water applications where required.

8. Field experience records and/or trial mix data for the proposed concrete mixes for each class of concrete specified herein.

9. Drying shrinkage test results from trial concrete mixes.

1.05 QUALITY ASSURANCE

A. Tests on materials used in the production of concrete shall be required as specified in Part 2 – Products. These tests shall be performed by an independent testing laboratory approved by the Engineer at no additional cost to the Owner.

B. Trial concrete mixes shall be tested when required in accordance with Article 3.01 of this Section at no additional cost to the Owner.

C. Field quality control tests, as specified in Article 3.10 of this Section, unless otherwise stated, will be performed by a materials testing consultant employed by the Owner. However, the Contractor shall be charged for the cost of any additional tests and investigation on work performed which does not meet the Specifications. Any individual who samples and tests concrete to determine if the concrete is being produced in accordance with this Specification shall be certified as a Concrete Field-Testing Technician, Grade I, in accordance with ACI CP-2. Testing laboratory shall conform to requirements of ASTM C-1077.

1.06 CONCRETE COORDINATION CONFERENCE

A. Unless waived by the Engineer, prior to any concrete submittals and at least 35 days prior to the start of the concrete construction schedule, the Contractor shall conduct a meeting at the site. The purpose of the meeting is to review the proposed concrete mix designs, to discuss the proposed approaches and procedures for mixing, transporting, placing, testing, finishing, and curing of all aspects of concrete work to ensure the concrete construction is performed in accordance with the Specifications, and to clarify roles of the parties involved. The Contractor shall send a concrete coordination conference agenda to all attendees 20 days prior to a mutually agreed upon date for the conference.

B. As a minimum the agenda shall include:

1. Concrete Materials and Mix Designs
2. Inspection Responsibilities
3. Concrete Sampling and Testing Specification Requirements
4. Cylinder Storage and Transportation
5. Acceptance/Rejection Responsibility and Authority for Fresh Concrete
6. Concrete finishing
7. Concrete Curing
8. Test Report Distribution
9. Miscellaneous Items

C. The Contractor shall require responsible representatives of every party who is concerned with the concrete work to attend the conference, including but not limited to the following:

1. Contractor's superintendent
2. Engineer
3. Owner's representative (if they choose to attend)
4. Laboratory retained for trial batching and construction quality control testing for the concrete.
5. Any subcontractors involved in placing, finishing, and curing of concrete
6. Concrete supplier
7. Concrete pumping subcontractor (if pumping is being proposed)

D. Minutes of the meeting shall be recorded, typed, and printed by the Contractor and distributed to all attendees and any other concerned parties within five days of the meeting.

PART 2 – PRODUCTS

2.01 HYDRAULIC CEMENT

A. Portland Cement

1. Portland Cement shall be Type II conforming to ASTM C 150. Type I cement may be used provided either fly ash or slag cement is also included in the mix in accordance with Articles 2.02 or 2.03 of this Section, respectively.
2. The proposed Portland Cement shall not contain more than 8% tricalcium aluminate and more than 12% tetracalcium aluminoferrite.
3. Portland Cement shall also meet performance requirements of ASTM C 1157.

B. Blended Cement

1. Blended cements shall be Type IP (Portland Fly Ash Cement), Type IS (Portland Slag Cement), or Type IL (Portland Limestone Cement) conforming to ASTM C 595.
2. Type IP cement shall be an inter-ground blend of Portland Cement and fly ash in which the fly ash constituent is between 15% and 25% of the weight of the total blend.
3. Type IS cement shall be an inter-ground blend of Portland Cement and slag cement in which the slag cement constituent is between 30% and 40% of the weight of the total blend.

4. Type IL cement shall be an inter-ground blend of Portland Cement and limestone in which the limestone constituent is between 5% and 15% of the weight of the total blend.

5. Fly ash, slag cement, and limestone used in the production of blended cements shall meet the requirements of Articles 2.02, 2.03, and 2.04 respectively.

6. Cements meeting ASTM C 1157 shall not be used in manufacture of blended cements.

7. Blended cement shall meet the Physical Requirements of Tables 2 and 3 of ASTM C 595 including the requirements for high sulfate resistance in Table 3 as tested per ASTM C1012.

C. Different types of cement shall not be mixed, nor shall they be used alternately except when authorized in writing by the Engineer. Different brands of cement or the same brand from different mills may be used alternately. A resubmittal will be required if different cements are proposed during the Project.

D. Cement shall be stored in a suitable weather-tight building to prevent deterioration or contamination. Cement which has become caked, partially hydrated, or otherwise damaged will be rejected.

2.02 FLY ASH

A. Fly ash shall meet the requirements of ASTM C 618 for Class F, except that the loss on ignition shall not exceed 4%. Fly ash shall also meet the optional physical requirements for uniformity as shown in Table 3 of ASTM C 618. Fly ash shall be considered as a supplemental cementitious material.

B. For fly ash to be used in the production of Type IP cement, the Pozzolan Activity Index shall be greater than 75% as specified in Table 3 of ASTM C 595.

C. Where reactive aggregates as defined in Article 2.07 are used in the concrete mix, the fly ash constituent shall be as needed to satisfy the concrete alkali loading requirements stipulated in Section 2.05. The percentage of fly ash shall also be set to meet the mean mortar bar expansion requirements in provisions of Article 2.07.G.2. Where fly ash is used, the minimum fly ash content shall be 15%.

D. For Type A1 concrete as required for use in environmental concrete structures, i.e., process structures or fluid containing structures, inclusion of fly ash or slag cement in the concrete mix, is mandatory.

E. Additional fly ash shall not be included in concrete mixed with Type IS or IP cement.

2.03 SLAG CEMENT

A. Slag cement shall meet the requirements of ASTM C 989 including tests for effectiveness of slag in preventing excessive expansion due to alkali-aggregate reactivity as described in Appendix X-3 of ASTM C 989.

B. Where reactive aggregates as defined in Article 2.07 are used in concrete mix, the slag cement constituent shall be as needed to satisfy the concrete alkali loading requirements stipulated in Section 2.05. The percentage of slag cement shall also be set to meet the mean mortar bar expansion requirements in provisions of Article 2.07.G.2. Where Slag Cement is used, the minimum Slag Cement content shall be 30%, and the maximum Slag Cement content shall be 40%.

C. For Type A1 concrete as required for use in environmental concrete structures, i.e., process structures or fluid containing structures, inclusion of fly ash or slag cement in the concrete mix, is mandatory.

D. Additional slag cement shall not be included in concrete mixed with Type IS or IP cement.

2.04 PORTLAND LIMESTONE CEMENT (TYPE IL)

A. Portland Limestone Cement (Type IL) cement shall meet the requirements of ASTM C 595.

B. Limestone used for blended cement Type IL shall be naturally occurring and meet the requirements of ASTM C 33.

C. Fly ash or slag cement shall be used with Type IL cement to meet requirements for durability, ASR resistance, sulfate resistance, and use for environmental structures, as specified herein.

2.05 CONCRETE ALKALI LOADING

A. All concrete mixes containing potentially reactive aggregates shall have a maximum alkali loading of the concrete of 3.0 pounds per cubic yard.

B. The alkali loading of concrete is the Portland Cement equivalent alkali content multiplied by the Portland Cement content of the mix in pounds per cubic yard divided by 100. The Portland Cement equivalent alkali content shall be included in the certified chemical analysis of the Portland Cement.

C. Means of evaluating alkali loading of concrete and proportioning constituents of concrete to minimize alkali loading of content shall also conform to the guidelines of ASTM C1778.

2.06 WATER

A. Water used for mixing concrete shall be clear, potable, and free from deleterious substances such as objectionable quantities of silty organic matter, alkali, salts, and other impurities.

B. Water shall not contain more than 100 PPM chloride.

C. Water shall not contain more than 500 PPM dissolved solids.

D. Water shall have a pH in the range of 4.5 to 8.5.

E. Water shall meet the requirements of ASTM C 1602.

2.07 AGGREGATES

A. All aggregates used in normal weight concrete shall conform to ASTM C 33.

B. Fine Aggregate (Sand) in the various concrete mixes shall consist of natural or manufactured siliceous sand, clean and free from deleterious substances, and graded within the limits of ASTM C 33.

C. Coarse aggregates shall consist of hard, clean, durable gravel, crushed gravel, or crushed rock. Coarse aggregate shall be size #57 or #67 as graded within the limits given in ASTM C 33 unless otherwise specified.

D. For Class A4 concrete, coarse aggregate shall be Size #8 in accordance with ASTM C33.

E. Aggregates shall be tested for gradation by sieve analysis tests in conformance with ASTM C 136.

F. Aggregates shall be tested for soundness in accordance with ASTM C 88. The loss resulting after five cycles shall not exceed 10 percent for fine or coarse aggregate when using either magnesium sulfate or sodium sulfate.

G. All aggregates shall be evaluated in accordance with ASTM C 1778 to determine potential reactivity. All aggregates shall be considered reactive unless they meet the requirements below for non-reactive aggregates. Aggregates with a lithology like sources in the same region found to be reactive in service shall be considered reactive regardless of the results of the tests above.

    1. Non-reactive aggregates shall meet the following requirements:

        a. A petrographic analysis in accordance with ASTM C295 shall be performed to identify the constituents of the fine and coarse aggregate. Non-reactive aggregates shall meet the following limitations:

1) Optically strained, micro-fractured, or microcrystalline quartz, 5.0%, maximum.

2) Chert or chalcedony, 3.0%, maximum.

3) Tridymite or cristobalite, 1.0%, maximum.

4) Opal, 0.5%, maximum.

5) Natural volcanic glass in volcanic rocks, 3.0%, maximum.

2. Concrete mixed with reactive aggregates shall meet the following requirements:

a. If aggregates are deemed potentially reactive as per ASTM C1778 and fly ash or slag cement is included in proposed concrete mix design, proposed concrete mix including proposed aggregates shall be evaluated by ASTM C-1567. Mean mortar bar expansions at 16 days shall be less than 0.08%. Tests shall be made using exact proportion of all materials proposed for use on the job in design mix submitted.

b. If aggregates are deemed potentially reactive as per ASTM C-1778 and a straight cement mix without fly ash or slag cement is proposed for concrete mix design, aggregates shall be evaluated by ASTM C-1260. Mean mortar bar expansions at 16 days shall be less than 0.08%.

c. If the proposed aggregates are deemed potentially reactive, the concrete mix shall be evaluated and confirmed to meet the requirements for concrete alkali loading as stipulated in Section 2.05.

H. Contractor shall submit a new trial mix to the Engineer for approval whenever a different aggregate or gradation is proposed.

2.08 SYNTHETIC FIBERS

A. Micro-synthetic fibers shall meet requirements of ASTM C 1116 and shall provide a minimum cracking reduction ratio (CRR) of 40 percent when tested in accordance with ASTM C 1579.

1. Acceptable products are:

a. MasterFiber F Series or M Series by Master Builders Solutions;

b. Or approved equal.

2. Micro-synthetic fibers shall be included in cement grout mixes where grout topping is to be swept into place by equipment mechanism.

B. Macro-synthetic fibers shall meet the requirements of ASTM C 1116 and shall have a minimum equivalent flexural strength ratio of 25 percent when tested in accordance with ASTM C 1609.

1. Acceptable products are:

a. MasterFiber MAC Series by Master Builders Solutions;

b. Tuf Strand SF by the Euclid Chemical Company;

c. Strux 90/40 by W.R. Grace;

d. Or approved equal.

C. Fibers shall be used only where specifically required on Contract Drawings or where specifically approved by Engineer.

2.09 ADMIXTURES

A. Admixtures containing intentionally added chlorides shall not be used.

B. Admixtures containing 1,4 Dioxane shall not be used.

C. Air entraining admixture shall be added to all concrete unless noted otherwise. The air entraining admixture shall conform to ASTM C 260. The admixture proposed shall be selected in advance so that adequate samples may be collected, and the required tests made. Air content of concrete, when placed, shall be within the ranges given in the concrete mix design.

D. The following admixtures are required or used for water reduction, slump increase, and/or adjustment of initial set, and enhancing durability. Admixtures permitted shall confirm to the requirements of ASTM C 494. Admixtures shall be non-toxic after 30 days and shall be compatible with and made by the same manufacturer as the air-entraining admixtures.

1. Water reducing admixture shall conform to ASTM C 494, Type A and shall contain no more than 0.05% chloride ions.

a. Acceptable products are:

1) “Eucon Series” by the Euclid Chemical Company;

2) “Master Pozzolith Series or Master Polyheed Series” by Master Builders Solutions;

3) “Plastocrete Series” by Sika Corporation;

4) Or approved equal.

2. High range water reducer shall conform to ASTM C 494, Type F or G. The high range water reducer shall be added to the concrete at the batch plant and may be used in conjunction with a water reducing admixture. The high range water reducer shall be accurately measured, and pressure injected into the mixer as a single dose by an experienced technician. A standby system shall be provided and tested prior to each day's operation of the job site system. Concrete shall be mixed at mixing speed for a minimum of 100 mixer revolutions after the addition of the high range water reducer.

    a. Acceptable products are:

        1) "Eucon 37" or Plastol 5000 by the Euclid Chemical Company;

        2) "Master Rheobuild 1000 or Master Glenium Series" by Master Builders Solutions;

        3) "Daracem 100 or Advaflow Series" by W.R. Grace;

        4) Or approved equal.

3. A non-chloride, non-corrosive accelerating admixture may be used where specifically approved by the Engineer. The admixture shall conform to ASTM C 494, Type C or E. The admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory (of at least a year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures.

    a. Acceptable products are:

        1) "MasterSet AC 534 or MasterSet FP 20" by Master Builders Solutions;

        2) "Accelguard 80/90 or NCA" by the Euclid Chemical Company;

        3) "Daraset" by W.R. Grace;

        4) Or approved equal.

4. A retarding admixture may be used where specifically approved by the Engineer. The admixture shall conform to ASTM C494, Type B or D.

    a. Acceptable products are:

        1) "Eucon NR or Eucon Retarder 100" by the Euclid Chemical Compan;

2) "MasterSet R Series or MasterSet DELVO Series" by Master Builders Solutions;

3) "Plastiment" by Sika Corporation;

4) Or approved equal.

5. Workability Retaining Admixture shall conform to ASTM C 494, Type S. The admixture shall retain concrete workability without affecting time of setting or early-age strength development.

   a. Acceptable products are:

      1) "MasterSure Z 60" by Master Builders Solutions;

      2) Or approved equal.

6. A crystalline permeability reducing admixture shall be used where specifically indicated on the Drawings or required herein. The admixture shall conform to ASTM C 494, Type S. The admixture shall be of the crystalline type that chemically controls and permanently establishes a non-soluble crystalline structure throughout the capillary voids and cracks within the concrete. The crystalline structure shall assist in sealing the concrete to minimize both infiltration and exfiltration of liquids from any direction. The admixture shall be capable of sealing hairline cracks and resisting hydrostatic pressure.

   a. Acceptable products are:

      1) "Xypex Admix C-500 NF" by Xypex Chemical Corporation;

      2) "MasterLife® 300 Series" by Master Builders Solution;

      3) "Krystol Internal Membrane (KIM)" by Kryton International Inc.;

      4) Or approved equal.

   b. Submit certified letter from manufacturer of crystalline admixture stating required dosage rate for job specific concrete mix. Concrete truck ticket shall confirm crystalline admixture was included in concrete being placed.

7. A shrinkage reducing admixture shall be used where specifically indicated on the drawings.

   a. Acceptable products include:

      1) Tetraguard AS20 by BASF;

      2) Eclipse by W. R. Grace;

3) Eucon SRA by Euclid Chemical Company;

4) Or approved equal.

E. Admixtures containing calcium chloride, thiocyanate or more than 0.05 percent chloride ions are not permitted. The addition of admixtures to prevent freezing is not permitted.

F. The Contractor shall submit manufacturer's data including the chloride ion content of each admixture and certification from the admixture manufacturer that all admixtures utilized in the design mix are compatible with one another and properly proportioned prior to mix design review.

2.10 CONCRETE MIX DESIGN

A. The proportions of cement, aggregates, admixtures, and water used in the concrete mixes shall be based on laboratory trial mixes in conformance with ACI 301. Trial mixes shall also conform to Article 3.01 of this Section. Trial mix data used as the basis for the proposed concrete mix design shall be submitted to the Engineer along with the proposed mix.

B. Structural concrete shall conform to the following requirements. Cementitious materials refer to the total combined weight of all cement, fly ash, and slag cement contained in the mix.

1. Compressive Strength (28-Day)

Concrete Class A1, A5	4,500 psi (min.), 6500 psi (max.)
Concrete Class A2, A3, A4	4,000 psi (min.), 6000 psi (max.)
Concrete Class B	3,000 psi (min.), 5000 psi (max.)

2. Water/cementitious materials ratio, by weight

	Maximum	**Minimum**
Concrete Class A1, A5	0.42	0.39
Concrete Class A2, A3, A4	0.45	0.39
Concrete Class B	0.50	0.39

3. Slump range

a. 4" nominal unless high range water reducing admixture is used

b. 8” max if high range water reducing admixture is used.

4. Air Content

Concrete Class A1, A2, A4, A5	6% ±1.5%
Concrete Class A3, B	3% Max (non-air-entrained)

PART 3 – EXECUTION

3.01 TRIAL MIXES

A. Trial mixes shall be used to confirm the quality of a proposed concrete mix in accordance with ACI 301. An independent qualified testing laboratory designated and retained by the Contractor shall test a trial batch of each of the preliminary concrete mixes submitted by the Contractor. The trial batches shall be prepared using the aggregates, cement, supplementary cementitious materials, and admixtures proposed for the project. The trial batch materials shall be of a quantity such that the testing laboratory can obtain enough samples to satisfy requirements stated below. Tests on individual materials stated in PRODUCTS should already be performed before any trial mix is done. The cost of laboratory trial batch tests for each specified concrete mix will be borne by the Contractor and the Contractor shall furnish and deliver the materials to the testing laboratory at no cost to the Owner.

B. The independent testing laboratory shall prepare a minimum of fifteen (15) standard test cylinders in accordance with ASTM C 31 in addition to conducting slump (ASTM C 143), air content (C 231) and density (C 138) tests. Compressive strength test on the cylinders shall subsequently be performed by the same laboratory in accordance with ASTM C 39 as follows: Test 3 cylinders at age 7 days; test 3 cylinders at age 21 days; test 3 cylinders at age 28 days and test 3 cylinders at 56 days. The cylinders shall be carefully identified as "Trial Mix, Contract No. “. If the average 28-day compressive strength of the trial mix is less than that specified, or if any single cylinder falls below the required strength by more than 500 psi, the mix shall be corrected, another trial batch prepared, test cylinders taken, and new tests performed as before. Any such additional trial batch testing required shall be performed at no additional cost to the Owner. Adjustments to the mix shall be considered refinements to the mix design and shall not be the basis for extra compensation to the Contractor.

3.02 SHRINKAGE TESTS

A. Concurrent with the trial batch requirements stated in Article 3.01, the testing laboratory shall perform drying shrinkage tests for the trial batches as specified herein. Shrinkage testing is only required for concrete to be used for environmental concrete structures (Class A1).

B. Fabricate, cure, dry, and measure specimens in accordance with ASTM C157 modified as follows.

1. Remove specimens from molds at an age of 23 hours ± 1 hour after trial batching.

2. Place specimens immediately in water at 70 ^{o}F ± 3 ^{o}F for at least 30 minutes.

3. Measure within 30 minutes thereafter to determine original length, then submerge in saturated lime water at 73 ^{o}F ± 3 ^{o}F.

4. At age seven days, measure to determine expansion, expressed as a percentage of original length. This length at age seven days shall be the base length for drying shrinkage calculations (zero days' drying age).

5. Store specimens immediately in a humidity-controlled room maintained at 73 ^{o}F ± 3 ^{o}F and 50 percent ± 4 percent relative humidity for the remainder of the test.

6. Make and report separately, measurements to determine shrinkage expressed as base length percentage for 7, 14, 21, and 28 days of drying after 7 days of moist curing.

C. Compute the drying shrinkage deformation for each specimen as the difference between the base length (at zero days' drying age) and the length after drying at each test age. Compute the average drying shrinkage deformation for the specimens to the nearest 0.0001 inch at each test age. If the drying shrinkage for any specimen departs from the average test age for that test by more than 0.0004 inch, disregard the results obtained from that specimen. Report results from the shrinkage test to the nearest 0.001 percent of shrinkage. Take compression test specimens in each case from the same concrete used for preparing drying shrinkage specimens. These tests shall be considered part of the normal compression tests for the project.

D. The maximum concrete shrinkage for specimens cast in the laboratory from the trial batch, as measured at 21-day drying age or at 28-day drying age, shall be 0.036 or 0.042 percent, respectively. Use a mix design for construction that has first met the trial batch shrinkage requirements.

E. If the trial batch specimens do not meet both the strength and shrinkage requirements, revise the mix designs and/or materials and retest.

3.03 PRODUCTION OF CONCRETE

A. All concrete shall be machine mixed. Hand mixing of concrete will not be permitted. The Contractor may supply concrete from a ready-mix concrete plant or from a site mixed plant. In selecting the source for concrete production, the Contractor shall carefully consider its capability for providing quality concrete at a rate commensurate with the

requirements of the placements so that well bonded, homogenous concrete, free of cold joints, is assured.

B. Ready-Mixed Concrete

1. At the Contractor's option, ready-mixed concrete may be used meeting the requirements for materials, batching, mixing, transporting, and placing as specified herein and in accordance with ASTM C 94.

2. Truck mixers shall be equipped with electrically actuated counters by which the number of revolutions of the drum or blades may be readily verified. The counter shall be of the resettable, recording type, and shall be mounted in the driver's cab. The counters shall be actuated at the time of starting mixers at mixing speeds.

3. Each batch of concrete shall be mixed in a truck mixer for not less than 100 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. All materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolutions of mixing.

4. Truck mixers and their operation shall be such that the concrete throughout the mixed batch, as discharged, is within acceptable limits of uniformity with respect to consistency, mix and grading. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than one inch when the specified slump is 3 inches or less, or if they differ by more than 2 inches when the specified slump is more than 3 inches, the mixer shall not be used on the work unless the causing condition is corrected and satisfactory performance is verified by additional slump tests. All mechanical details of the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit and clearance of the drum, shall be checked before a further attempt to use the unit will be permitted.

5. Ready-mixed concrete shall be delivered to the site for the work and discharge shall be completed within the time requirements stated in Article 3.04 of this Section.

6. Every concrete delivery shall be accompanied by a delivery ticket containing at least the following information:

a. Date and truck number

b. Ticket number

c. Mix designation of concrete

d. Cubic yards of concrete

e. Cement brand, type, and weight in pounds

f. Weight in pounds of fine aggregate (sand)

g. Weight in pounds of coarse aggregate (stone)

h. Air entraining agent, brand, and weight in pounds and ounces

i. Other admixtures, brand, and weight in pounds and ounces

j. Water, in gallons, stored in attached tank

k. Water, in gallons, maximum that can be added without exceeding design water/cementitious materials ratio

l. Water, in gallons, used (by truck driver)

m. Time of loading

n. Time of delivery to job (by truck driver)

7. Any truck delivering concrete to the job site, which is not accompanied by a delivery ticket showing the above information will be rejected and such truck shall immediately depart from the job site.

8. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted. Combination truck and trailer equipment for transporting ready-mixed concrete will not be permitted. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates shall be subject to inspection at the batching plant by the Engineer.

C. Site Mixed Concrete

1. Scales for weighing concrete ingredients shall be accurate when in use within ±0.4 percent of their total capacities. Standard test weights shall be available to permit checking scale accuracy.

2. Operation of batching equipment shall be such that the concrete ingredients are consistently measured within the following tolerances:

a.	Cement, fly ash, or slag cement	± 1 percent
b.	Water	± 1 percent
c.	Aggregates	± 2 percent
d.	Admixtures	± 3 percent

3. Each batch shall be so charged into the mixer that some water will enter in advance of the cement and aggregates. Water shall continue for a period which may extend to the end of the first 25 percent of the specified mixing time. Controls shall be provided to prevent batched ingredients from entering the mixer before the previous batch has been completely discharged.

4. The concrete shall be mixed in a batch mixer capable of thoroughly combining the aggregates, cement, and water into a uniform mass within the specified mixing time, and of discharging the concrete without harmful segregation. The mixer shall bear a manufacturer's rating plate indicating the rate capacity and the recommended revolutions per minute and shall be operated in accordance therewith.

5. Mixers with a rated capacity of one cubic yard or larger shall conform to the requirements of the Plant Mixer Manufacturers' Division of the Concrete Plant Manufacturers' Bureau.

6. Except as provided below, batches of one cubic yard or less shall be mixed for not less than one minute. The mixing time shall be increased 15 seconds for each cubic yard or fraction thereof of additional capacity.

7. Shorter mixing time may be permitted provided performance tests made in accordance with ASTM C 94 indicate that the time is sufficient to produce uniform concrete.

8. Controls shall be provided to ensure that the batch cannot be discharged until the required mixing time has elapsed. At least three-quarters of the required mixing time shall take place after the last of the mixing water has been added.

9. The interior of the mixer shall be free of accumulations that will interfere with mixing action. Mixer blades shall be replaced when they have lost 10 percent of their original height.

10. Air-entraining admixtures and other chemical admixtures shall be charged into the mixer as solutions and shall be measured by means of an approved mechanical dispensing device. The liquid shall be considered a part of the mixing water. Admixtures that cannot be added in solution may be weighed or may be measured by volume if recommended by the manufacturer.

11. If two or more admixtures are used in the concrete, they shall be added separately to avoid possible interaction that might interfere with the efficiency of either admixture or adversely affect the concrete.

12. Addition of retarding admixtures shall be completed within one minute after addition of water to the cement has been completed, or prior to the beginning of the last three-quarters of the required mixing, whichever occurs first. Retarding admixtures shall not be used unless approved by the Engineer.

13. Concrete shall be mixed only in quantities for immediate use and within the time and mixing requirements of ASTM C 94.

3.04 CONCRETE PLACEMENT

A. No concrete shall be placed prior to approval of the concrete mix design. Concrete placement shall conform to the recommendations of ACI 304.

B. Prior to concrete placement, all reinforcement shall be securely and properly fastened in its correct position. Formwork shall be clean, oiled and form ties at construction joints shall be retightened. All bucks, sleeves, castings, hangers, pipe, conduits, bolts, anchors, wire, and any other fixtures required to be embedded therein shall be in place. Forms for openings to be left in the concrete shall be in place and anchored by the Contractor. All loose debris in bottoms of forms or in keyways shall be removed and all debris, water, snow, ice, and foreign matter shall be removed from the space to be occupied by the concrete. The Contractor shall notify the Engineer in advance of placement, allowing sufficient time for a concurrent inspection and for any corrective measures required.

C. On horizontal joints where concrete is to be placed on hardened concrete, flowing concrete containing a high range water reducing admixture or cement grout shall be placed with a slump not less than 8 inches for the initial placement at the base of the wall. Concrete or cement grout shall meet all strength and service requirements specified herein for applicable class of concrete. This concrete shall be worked well into the irregularities of the hard surface.

D. All concrete shall be placed during the daylight hours except with the consent of the Engineer. If special permission is obtained to carry on work during the night, adequate lighting must be provided.

E. When concrete arrives at the project with slump below that suitable for placing, as indicated by the Specifications, water may be added to bring the concrete within the specified slump range provided the design water-cementitious materials ratio is not exceeded. The water shall be incorporated by additional mixing equal to at least half of the total mixing required. Water may be added only to full trucks. On-site tempering shall not relieve the Contractor from furnishing a concrete mix meeting all specified requirements.

F. Concrete shall be conveyed as rapidly as practical to the point of deposit by methods which prevent the separation or loss of the ingredients. The concrete shall be deposited so that additional handling will be unnecessary. Discharge of the concrete to its point of deposit shall be completed within 90 minutes after the addition of the cement to the aggregates unless workability-retaining admixtures are included and approved by the Engineer. In hot weather, or under conditions contributing to quick stiffening of the concrete, the time between the introduction of the cement to the aggregates and discharge shall not exceed the requirements stated in Article 3.09 of this Section.

G. Where concrete is conveyed to position by chutes, a continuous flow in the chute shall be maintained. The angle and discharge arrangement of the chute shall be such to prevent segregation of the concrete ingredients. The delivery end of the chute shall be as close as possible to the point of deposit and in no case shall the free pour from the delivery end of the chute exceed five feet, unless approved otherwise.

H. Special care must be exercised to prevent splashing of forms or reinforcement with concrete, and any such splashes or accumulations of hardened or partially hardened concrete on the forms or reinforcement above the general level of the concrete already in place must be removed before the work proceeds.

I. Placing of concrete shall be regulated so the pressure caused by the wet concrete shall not exceed that used in the design of the forms.

J. All concrete for walls shall be placed through openings in the form spaced at frequent intervals or through tremies (heavy duct canvas, rubber, etc.), equipped with suitable hopper heads. Tremies shall be of variable lengths so the free fall shall not exceed five (5) feet, and enough tremies shall be placed in the form to ensure the concrete remains level.

K. When placing concrete which will be exposed, sufficient illumination shall be provided in the interior of the forms so the concrete, at places of deposit, is visible from deck and runways.

L. Concrete shall be placed to thoroughly embed all reinforcement, inserts, and fixtures.

M. When forms are removed, surfaces shall be even and dense, free from aggregate pockets or honeycomb. Concrete shall be consolidated using mechanical vibration, supplemented by forking and spading by hand in the corners and angle of forms and along form surfaces while the concrete is plastic under the vibratory action. Consolidation shall conform to ACI 309.

N. Mechanical vibration shall be applied directly to the concrete, unless otherwise approved by the Engineer. The bottom of vibrators used on floor slabs must not be permitted to ride the form supporting the slab. Vibration shall be applied at the point of deposit and in freshly placed concrete by a vertical penetration of the vibrator. Vibrators shall not be used to move concrete laterally within the forms.

O. The intensity of vibration shall be sufficient to cause settlement of the concrete into place and to produce monolithic joining with the preceding layer. Vibration shall be of sufficient duration to accomplish thorough compaction and complete embedment of reinforcement and fixtures with a vibrator transmitting not less than 7,500 impulses per minute. Since the duration of vibration per square foot of surface is dependent on the frequency (impulses per minute), size of vibrator, and slump of concrete, the length of time must therefore be determined in the field. Vibration shall not be continued in any one location to the extent that pools of grout are formed.

P. Care shall be taken to prevent cold joints when placing concrete in any portion of the work. The concrete placing rate shall ensure that each layer is placed while the previous layer is soft or plastic, so the two layers can be made monolithic by penetration of the vibrators. Maximum thickness of concrete layers shall be 18 inches. The surface of the concrete shall be level whenever a run of concrete is stopped.

Q. To prevent featheredges, construction joints located at the tops of horizontal lifts near sloping exposed concrete surfaces shall be inclined near the exposed surface, so the angle between such inclined surface and the exposed concrete surface will be not less than 50°.

R. In placing unformed concrete on slopes, the concrete shall be placed ahead of a non-vibrated slip-form screed extending approximately 2-1/2 feet back from its leading edge. The method of placement shall provide a uniform finished surface with the deviation from the straight line less than 1/8 inch in any concrete placement. Concrete ahead of the slip-form screed shall be consolidated by internal vibrators to ensure complete filling under the slip-form. Prior to placement of concrete on sloped walls or slabs, the Contractor shall submit a plan specifically detailing methods and sequence of placements, proposed concrete screed equipment, location of construction joints and water stops, and/or any proposed deviations from the stated requirements to the Engineer for review and approval.

S. Concrete shall not be placed during rains sufficiently heavy or prolonged to prevent washing of mortar from coarse aggregate on the forward slopes of the placement. Once placement of concrete has commenced in a block, placement shall not be interrupted by diverting the placing equipment to other uses.

3.05 PLACING FLOOR SLABS ON GROUND

A. The subgrade for slabs on ground shall be well drained and of adequate and uniform loadbearing nature. The in-place density of the subgrade soils shall be at least the minimum required by the Specifications. No foundation, slab, or pavement concrete shall be placed until the depth and character of the foundation soils have been inspected and approved by the materials testing consultant.

B. The subgrade shall be free of frost before concrete placing begins. If the temperature inside a building where concrete is to be placed is below freezing, the temperature shall be raised and maintained above 50° long enough to remove all frost from the subgrade.

C. The subgrade shall be moist at the time of concreting. If necessary, the subgrade shall be dampened with water in advance of concreting, but no free water shall remain standing on the subgrade nor any muddy or soft spots when the concrete is placed.

D. Thirty-pound felt-paper shall be provided between edges of slabs-on-ground and vertical and horizontal concrete surfaces, unless otherwise indicated on the Drawings.

E. Contraction joints shall be provided in slabs-on-ground at locations indicated on the Drawings. Contraction joints shall be installed as per Section 03 15 16 – Joints in Concrete.

F. Floor slabs shall be screeded level or pitched to drain as indicated on the Drawings. Finishes shall conform with requirements of Section 03 35 00 – Concrete Finishes. Interior floor slabs shall be placed with non-air-entrained concrete (Class A3) if a steel troweled or hardened finish is required.

3.06 PLACING CONCRETE UNDER PRESSURE

A. Where concrete is conveyed and placed by mechanically applied pressure, the equipment shall have the capacity for the operation. The operation of the pump shall produce a continuous stream of concrete without air pockets. To obtain the least line resistance, the layout of the pipeline system shall contain minimum bends with no change in pipe size. If two sizes of pipe must be used, the smaller diameter should be used at the pump end and the larger at the discharge end. When pumping is completed, the concrete remaining in the pipelines shall be ejected in such a manner that there will be no contamination of the concrete or separation of the ingredients.

B. Priming of the concrete pumping equipment shall be with cement grout only. Use of specialty mix pump primers or pumping aids will not be allowed.

C. No aluminum parts shall be in contact with the concrete during the placing of concrete under pressure.

D. Prior to placing concrete under pressure, the Contractor shall submit the concrete mix design together with test results from a material's testing consultant proving the proposed mix meets all requirements. In addition, an actual pumping test under field conditions is required prior to acceptance of the mix. This test requires a duplication of anticipated site conditions from beginning to end. The batching and truck mixing shall be the same as will be used during construction, and the pipe and pipe layouts will reflect the maximum height and distance contemplated. All submissions shall be subject to approval by the Engineer.

E. If the pumped concrete does not produce satisfactory end results, the Contractor shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.

F. The pumping equipment must have two cylinders and be designed to operate with one cylinder only in case the other one is not functioning. In lieu of this requirement, the Contractor may have a standby pump on the site during pumping.

G. The minimum diameter of the hose (conduits) shall be four inches.

H. Pumping equipment and hoses (conduits) that are not functioning properly shall be replaced.

I. Concrete samples for quality control in accordance with Article 3.10 of this Section will be taken at the placement (discharge) end of the line.

3.07 ORDER OF PLACING CONCRETE

A. To minimize the effects of shrinkage, the concrete shall be placed in units as bounded by construction joints shown on the Drawings and maximum lengths as indicated on Drawings. Where required on the Drawings and wherever else practical, the placing of such units shall be done in a strip pattern in accordance with ACI 302.1. A minimum of 72 hours shall pass prior to placing concrete directly adjacent to previously placed concrete.

3.08 CONCRETE WORK IN COLD WEATHER

A. Cold weather concreting procedures shall conform to the requirements of ACI 306.1.

B. The Engineer may prohibit the placing of concrete at any time when air temperature is 40°F. or lower. If concrete work is permitted, the concrete shall have a minimum temperature, as placed, of 55°F. for placements less than 12" thick, 50°F. for placements 12" to 36" thick, and 45°F. for placements greater than 36" thick. The temperature of the concrete as placed shall not exceed these minimum values by more than 20°F, unless otherwise approved by the Engineer.

C. All aggregate and water shall be preheated. Precautions shall be taken to avoid the possibility of flash set when aggregate or water are heated to a temperature greater than 100°F. to meet concrete temperature requirements. The addition of admixtures to the concrete to prevent freezing is not permitted. All reinforcement, forms, and concrete accessories shall be defrosted by an approved method. No concrete shall be placed on frozen ground.

3.09 CONCRETE WORK IN HOT WEATHER

A. Hot weather concreting procedures shall conform to the requirements of ACI 305.1.

B. When air temperatures exceed 85°F., or when extremely dry or high wind conditions exist even at lower temperatures, the Contractor and his concrete supplier shall exercise special and precautionary measures in preparing, delivering, placing, finishing, curing, and protecting the concrete mix. The Contractor shall consult with the Engineer regarding such measures prior to each day's placing operation, and the Engineer reserves the right to modify the proposed measures consistent with the requirements herein. All necessary materials and equipment shall be in place prior to each placing operation.

C. Preparatory work at the job site shall include thorough wetting of all forms, reinforcing steel and, in the case of slab pours on ground or subgrade, spraying the ground surface on the preceding evening and again just prior to placing. No standing puddles of water shall be permitted in those areas which are to receive the concrete.

D. The temperature of the concrete mix when placed shall not exceed 95°F.

E. Temperature of mixing water and aggregates shall be carefully controlled and monitored at the supplier's plant, with haul distance to the job site being considered. Stockpiled aggregates shall be shaded from the sun and sprinkled intermittently with water. If ice is used in the mixing water for cooling purposes, the ice must be entirely melted prior to addition of the water to the dry mix.

F. Delivery schedules shall be carefully considered in advance to ensure concrete is placed as soon as practical after mixing. For hot weather concrete work (air temperature greater than 85°F), discharge of the concrete to its point of deposit shall be completed within 60 minutes from the time the concrete is batched, unless workability-retaining admixtures are included and approved by the Engineer.

G. The Contractor shall arrange for an ample work force to be on hand to accomplish transporting, vibrating, finishing, and covering of the fresh concrete as rapidly as possible.

3.10 QUALITY CONTROL

A. Field Testing of Concrete

1. The Contractor shall coordinate with the Engineer's project representative the on-site scheduling of the materials testing consultant personnel as required for concrete testing.

2. Concrete for testing shall be supplied by the Contractor at no additional cost to the Owner, and the Contractor shall assist the materials testing consultant in obtaining samples. The Contractor shall dispose of and clean up all excess material.

B. Consistency

1. The consistency of the concrete will be checked by the materials testing consultant by standard slump cone tests. The Contractor shall make any necessary adjustments in the mix as the Engineer and/or the materials testing consultant may direct and shall upon written order suspend all placing operations in the event the consistency does not meet the intent of the specifications. No payment shall be made for any delays, material, or labor costs due to such occurrences.

2. Slump tests shall be made in accordance with ASTM C 143. Slump tests will be performed as deemed necessary by the materials testing consultant and each time compressive strength samples are taken.

3. Concrete with a specified nominal slump shall be placed having a slump within 1” (higher or lower) of the specified slump. Concrete with a specified maximum slump shall be placed having a slump less than the specified slump.

C. Density

1. Samples of freshly mixed concrete shall be tested for density by the materials testing consultant in accordance with ASTM C 138.

2. Density tests will be performed as deemed necessary by the Engineer and each time compressive strength samples are taken.

D. Air Content

1. Samples of freshly mixed concrete will be tested for entrained air content by the materials testing consultant in accordance with ASTM C 231.

2. Air content tests will be performed as deemed necessary by the materials testing consultant and each time compressive strength samples are taken.

3. In the event test results are outside the limits specified, additional testing shall occur. Admixture quantity adjustments shall be made immediately upon discovery of incorrect air entrainment.

E. Compressive Strength

1. Samples of freshly mixed concrete will be taken by the materials testing consultant and tested for compressive strength in accordance with ASTM C 172, C 31, and C 39, except as modified herein.

2. In general, one sampling shall be taken for each placement more than five (5) cubic yards, with a minimum of one (1) sampling for each day of concrete placement operations, or for each one hundred (100) cubic yards of concrete, or for each 5,000 square feet of surface area for slabs or walls, whichever is greater.

3. Each sampling shall consist of at least five (5) 6x12 cylinders or (8) 4x8 cylinders. Each cylinder shall be identified by a tag, which shall be hooked or wired to the side of the container. The materials testing consultant will fill out the required information on the tag, and the Contractor shall satisfy himself that such information shown is correct.

4. The Contractor shall be required to furnish labor to the Owner for assisting in preparing test cylinders. The Contractor shall provide approved curing boxes for storage of cylinders on site. The insulated curing box shall be of sufficient size and strength to contain all the cylinders made in any four consecutive working days and to protect the specimens from falling over, being jarred, or otherwise disturbed during the period of initial curing. The box shall be erected, furnished, and maintained by the Contractor. Such box shall be equipped to provide the moisture and to regulate the temperature necessary to maintain the proper curing conditions required by ASTM C 31. The curing box shall be placed in an area free from vibration such as pile driving and traffic of all kinds and such that all cylinders are

shielded from direct sunlight and/or radiant heating sources. No concrete requiring testing shall be delivered to the site until such storage curing box has been provided. Cylinders shall remain undisturbed in the curing box until ready for delivery to the testing laboratory, but not less than sixteen hours.

5. The Contractor shall be responsible for maintaining the temperatures of the curing box during the initial curing of cylinders with the temperature preserved between 60°F and 80°F as measured by a maximum-minimum thermometer. The Contractor shall maintain a written record of curing box temperatures for each day the curing box contains cylinders. Temperature shall be recorded a minimum of three times a day with one recording at the start of the day and one recording at the end of the day.

6. When transported, the cylinders shall not be thrown, dropped, allowed to roll, or be damaged in any way.

7. Compression tests shall be performed in accordance with ASTM C 39. For 6x12 cylinders, two test cylinders will be tested at seven days and two at 28 days. For 4x8 cylinders, three test cylinders will be tested at seven days, three at 28 days. The remaining cylinders will be held to verify test results, if needed.

F. Evaluation and Acceptance of Concrete

1. Evaluation and acceptance of the compressive strength of concrete shall be according to the requirements of ACI 214, ACI 318, and ACI 350.

2. The strength level of concrete will be considered satisfactory if the following conditions are satisfied.

   a. Every arithmetic average of any three consecutive strength tests equals or exceeds the minimum specified 28-day compressive strength for the mix (see Article 2.10 of this Section).

   b. No individual compressive strength test result falls below the minimum specified strength by more than 500 psi.

3. If any of the conditions listed above are not met, the mix proportions shall be corrected for the next concrete placing operation.

4. If the condition required in Paragraph 3.10.F.2.b of this Article is not met, additional tests in accordance with Paragraph 3.10.H of this Article shall be performed.

5. When a ratio between 7-day and 28-day strengths has been established by these tests, the 7-day strengths shall subsequently be taken as a preliminary indication of the 28-day strengths. Should the 7-day test strength from any sampling be more than 10% below the established minimum strength, the Contractor shall:

a. Immediately provide additional periods of curing in the affected area from which the deficient test cylinders were taken.

b. Maintain or add temporary structural support as required.

c. Correct the mix for the next concrete placement operation, if required to remedy the situation.

6. All concrete which fails to meet the ACI requirements, and these specifications is subject to removal and replacement at no additional cost to the Owner.

G. When non-compliant concrete is identified, test reports shall be sent immediately to the Engineer for review.

H. Additional Tests

1. When ordered by the Engineer, additional tests on in-place concrete shall be provided and paid for by the Contractor.

2. If the 28-day test cylinders fail to meet the minimum strength requirements as outlined in Article 3.10, Paragraph F, of this Section, the Contractor shall have concrete core specimens obtained and tested from the affected area immediately.

a. Three cores shall be taken for each sample in which the strength requirements were not met.

b. The drilled cores shall be obtained and tested in conformance with ASTM C 42. The tests shall be conducted by a materials testing consultant approved by the Engineer.

c. The location from which each core is taken shall be approved by the Engineer. Each core specimen shall be located, when possible, so its axis is perpendicular to the concrete surface and not near formed joints or obvious edges of a unit of deposit.

d. The core specimens shall be taken, if possible, so no reinforcing steel is within the confines of the core.

e. The diameter of core specimens should be at least 3 times the maximum nominal size of the coarse aggregate used in the concrete but must be at least 2-inches in diameter.

f. The length of specimen, when capped, shall be at least twice the diameter of the specimen.

g. The core specimens shall be taken to the laboratory and when transported, shall not be thrown, dropped, allowed to roll, or damaged in any way.

h. Two (2) copies of test results shall be mailed directly to the Engineer. The concrete in question will be considered acceptable if the average compressive strength of a minimum of three test core specimens taken from a given area equal or exceed 85% of the specified 28-day strength and if the lowest core strength is greater than 75% of the specified 28-day strength.

3. If the concrete placed by the Contractor is suspected of not having proper air content, the Contractor shall engage a materials testing consultant approved by the Engineer, to obtain and test samples for air content in accordance with ASTM C 457.

3.11 CARE AND REPAIR OF CONCRETE

A. The Contractor shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance by the Owner. Care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Care shall be exercised to avoid jarring forms or placing any strain on the ends of projecting reinforcing bars. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at no additional cost to the Owner.

B. Areas of honeycomb shall be chipped back to sound concrete and repaired as directed.

C. Concrete formwork blowouts or unacceptable deviations in tolerances for formed surfaces due to improperly constructed or misaligned formwork shall be repaired as directed. Bulging or protruding areas, which result from slipping or deflecting forms shall be ground flush or chipped out and redressed as directed.

D. Areas of concrete in which cracking, spalling, or other signs of deterioration develop prior to final acceptance shall be removed and replaced or repaired as directed. This stipulation includes concrete that has experienced cracking due to drying or thermal shrinkage of the concrete. Structural cracks shall be repaired using an approved epoxy injection system. Non-structural cracks shall be repaired using an approved hydrophilic resin pressure injected grout system unless other means of repair are deemed necessary and approved. All repair work shall be performed at no additional cost to the Owner.

E. Concrete which fails to meet the strength requirements as outlined in Article 3.10, Paragraph F of this Section, will be analyzed as to its adequacy based upon loading conditions, resultant stresses, and exposure conditions for the area of concrete in question. If the concrete in question is found unacceptable based upon this analysis, that portion of the structure shall be strengthened or replaced by the Contractor at no

additional cost to the Owner. The method of strengthening or extent of replacement shall be as directed by the Engineer.

END OF SECTION

SECTION 03 35 00
CONCRETE FINISHES

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Furnish all materials, labor, and equipment required to provide finishes of all concrete surfaces specified herein and shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03 11 00 – Concrete Formwork

B. Section 03 30 00 – Cast-in-Place Concrete

C. Section 03 39 00 – Concrete Curing

D. Section 03 60 00 – Grout

E. Section 09 90 00 – Painting

F. Section 09 97 00 – Special Coatings

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. ACI 301 – Specifications for Structural Concrete for Buildings

2. ACI 318 – Building Code Requirements for Structural Concrete

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures.

1. Manufacturer’s literature on all products specified herein.

PART 2 – PRODUCTS

2.01 CONCRETE FLOOR SEALER

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A. Floor sealer shall be:

1. Diamond Clear VOX or Super Diamond Clear VOX by the Euclid Chemical Company;

2. MasterKure CC 300 SB by Master Builders Solutions;

3. Or approved equal.

2.02 CONCRETE LIQUID DENSIFIER AND SEALANT

A. Concrete liquid densifier and sealant shall be a high performance, deeply penetrating concrete densifier and sealant. Product shall be odorless, colorless, VOC-compliant, non-yellowing siliconate based solution designed to harden, dustproof, and protect concrete floors subjected to heavy vehicular traffic and to resist black rubber tire marks on concrete surfaces. The product must contain a minimum solids content of 20% of which 50% is siliconate.

B. Acceptable products are:

1. Diamond Hard by the Euclid Chemical Company;

2. Seal Hard by L&M Construction Chemicals;

3. Masterkure HD 200 WB by Master Builders Solutions;

4. Or approved equal.

2.03 NON-OXIDIZING HEAVY DUTY METALLIC FLOOR HARDENER

A. Non-oxidizing heavy-duty metallic floor hardener shall be formulated, processed, and packaged under stringent quality control at the manufacturer’s owned and controlled factory. The hardener shall be a mixture of specifically processed non-rusting aggregate, selected Portland cement, and necessary plasticizing agents.

B. Product shall be

1. “Diamond-Plate” by the Euclid Chemical Company;

2. MasterTop 200 by Master Builders Solutions;

3. Or approved equal.

2.04 NON-SLIP FLOORING ADDITIVE

A. Non-slip flooring additives for slip resistant floors shall be non-metallic.

B. Non-slip flooring additives shall be:

1. MasterTop 120SR by Master Builders Solutions;

2. A-H Alox by Anti-Hydro or Euco Grip by the Euclid Chemical Company;

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3. Or approved equal.

PART 3 – EXECUTION

3.01 FINISHES ON FORMED CONCRETE SURFACES

A. After removal of forms, the finishes described below shall be applied in accordance with Article 3.06 - Concrete Finish Schedule of this Section. Unless the finish schedule specifies otherwise, all surfaces shall receive at least a Type I finish. See Article 3.05 of this Section for surfaces to receive paint or protective coatings. The Engineer shall be the sole judge of acceptability of all concrete finish work.

1. Type I - Rough: All fins, burrs, offsets, marks, and all other projections left by the forms shall be removed. Projections, depressions, etc. below finished grade required to be removed will only be those greater than ¼-inch. All holes left by removal of ends of ties, and all other holes, depressions, bug holes, air/blow holes or voids shall be filled solid with cement grout after first being thoroughly wetted and then struck off flush. The only holes below grade to be filled will be tie holes and any other holes larger than ¼-inch in any dimension. Honeycombs shall be chipped back to solid concrete and repaired as directed by the Engineer. All holes shall be filled with tools, such as sponge floats and trowels, that will permit packing the hole solidly with cement grout. Cement grout shall consist of one-part cement to three parts sand, epoxy bonding agent (for tie holes only) and the amount of mixing water shall be as little as consistent with the requirements of handling and placing. Color of cement grout shall match the adjacent wall surface.

2. Type II - Grout Cleaned: Where this finish is required, it shall be applied after completion of Type I finish. After the concrete has been pre-dampened over an extended amount of time to reach the condition of saturated surface dry (SSD), a slurry consisting of one part cement (including an appropriate quantity of white cement to produce a color matching the surrounding concrete) and 1-1/2 parts sand passing the No. 16 sieve, by damp loose volume, shall be spread over the surface with clean burlap pads or sponge rubber floats. Mix proportions shall be submitted to the Engineer after a sample of the work is established and accepted. Any surplus shall be removed by scraping and then rubbing with clean burlap.

3. Type III - Smooth Rubbed: Where this finish is required, it shall be applied after the completion of the Type II finish. No rubbing shall be done before the concrete is thoroughly hardened and the mortar used for patching is firmly set. A smooth, uniform surface shall be obtained by wetting the surface and rubbing with a carborundum stone to eliminate irregularities. Unless the nature of the irregularities requires it, the general surface of the concrete shall not be cut into. Corners and edges shall be slightly rounded using a carborundum stone. Brush finishing or painting with grout or neat cement will not be permitted. A 100 square foot

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example shall be established at the beginning of the project to establish acceptability.

3.02 SLAB AND FLOOR FINISHES

A. The finishes described below shall be applied to floors, slabs, flow channels and top of walls in accordance with Article 3.06 - Concrete Finish Schedule of this Section. The Engineer shall be the sole judge of acceptability of all such finish work.

1. Type "A" - Screeded: This finish shall be obtained by placing screeds at frequent intervals and striking off to the surface elevation required. When a Type "F" finish is subsequently to be applied, the surface of the screeded concrete shall be roughened with a concrete rake to 1/2” minimum deep grooves prior to final set.

2. Type "B" - Wood or Magnesium Floated: This finish shall be obtained after completion of a Type "A" finish by working a previously screeded surface with a wood or magnesium float or until the desired texture is reached. Floating shall begin when the water sheen has disappeared and when the concrete has sufficiently hardened so that a person's foot leaves only a slight imprint. If wet spots occur, water shall be removed with a squeegee. Care shall be taken to prevent the formation of laitance and excess water on the finished surface. All edges shall be edged with an 1/8-inch tool as directed by the Engineer. The finished surface shall be true, even, and free from blemishes and any other irregularities.

3. Type "C" - Cork Floated: This finish shall be similar to Type "B" but slightly smoother than the finish obtained with a wood float. The finish shall be obtained by power or band floating with cork floats.

4. Type "D" - Steel Troweled: This finish shall be obtained after completion of a Type "B" finish. When the concrete has hardened sufficiently to prevent excess fine material from working to the surface, the surface shall be compacted and smoothed with not less than two thorough and complete steel troweling operations. In areas which are to receive a floor covering such as tile, resilient flooring, or carpeting, the applicable Specification Sections and Contract Drawings shall be reviewed for the required finishes and degree of flatness. In areas that are intermittently wet such as pump rooms, only one troweling operation is required to provide some trowel marks for slip resistance. All edges shall be edged with an 1/8-inch tool as directed by the Engineer. The finish shall be brought to a smooth, dense surface, free from defects and blemishes.

5. Type "E" - Broom or Belt: This finish shall provide the surface with a transverse scored texture by drawing a broom or burlap belt across the surface immediately after completion of a Type "B" finish. All edges shall be edged with an 1/8-inch tool as directed by the Engineer.

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6. Type "F" - Swept in Grout Topping: This finish shall be applied after a completion of a Type "A" finish. The concrete surface shall be properly cleaned, washed, and coated with a mixture of water and Portland Cement. Cement grout with inclusion of micro-synthetic fibers in accordance with Section 03 60 00 – Grout shall be plowed and swept into neat conformance with the blades or arms of the apparatus by turning or rotating the previously positioned mechanical equipment. Special attention shall be paid to true grades, shapes and tolerances as specified by the manufacturer of the equipment. Before beginning this finish, the Contractor shall notify the Engineer and the equipment manufacturer of the details of the operation and obtain approval and recommendations.

7. Type “G” Hardened Finish: This finish shall be applied after completion of a Type “B” or Type “C” finish and prior to application of a Type “D” finish. Hardeners shall be applied in strict accordance with the manufacturer’s requirements. Hardeners shall be applied using a mechanical spreader. The hardener shall be applied in two shakes with the first shake comprising 2/3 of the total amount. Type “D” finish shall be applied following completion of application of the hardener. Non-oxidizing, heavy-duty metallic floor hardener shall be applied at the loading docks and where specifically required on the Contract Drawings or specified herein at the rate of 1.5 pounds/ft.^{2}.

8. Type "H" - Non-Slip Finish: This finish shall be provided by applying a non-slip flooring additive concurrently with the application of a Type "D" finish and/or installation of floor sealants. Application procedure shall be in accordance with manufacturer's instructions. Finish shall be applied where specifically required on the Contract Drawings or specified herein.

9. Type "J" - Raked Finish: This finish shall be provided by raking the surface as soon as the condition of the concrete permits by making depressions of ±1/4 inch.

3.03 CONCRETE SEALERS

A. Concrete sealers shall be applied where specifically required on the Contract Drawings or specified herein. Concrete sealers and densifiers shall not be used as concrete curing compounds. Curing compounds, when allowed, shall be in accordance with Section 03 39 00 – Concrete Curing.

B. Sealers shall be applied after installation of all equipment, piping, etc. and after completion of any other related construction activities. Application of sealers shall be in strict accordance with manufacturer’s requirements.

C. Sealers shall be applied to all floor slabs not painted and not intended to be immersed.

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D. Floor slabs subjected to vehicular traffic shall be sealed with the concrete liquid densifier and sealer.

E. All other floor slabs to receive sealer shall be sealed with concrete floor sealer.

3.04 FINISHES ON EQUIPMENT PADS

A. Formed surfaces of equipment pads shall receive a Type III finish.

B. Top surfaces of equipment pads, except those surfaces subsequently required to receive grout and support equipment bases, shall receive a Type "D" finish, unless otherwise noted. Surfaces which will later receive grout shall, before the concrete takes its final set, be made rough by removing the sand and cement that accumulates on the top to the extent that the aggregate will be exposed with irregular indentations in the surface up to 1/2 inch deep.

3.05 FINISHES FOR SURFACES TO RECEIVE PAINT OR COATINGS

A. Surfaces indicated or specified to receive paint or special coatings shall be prepared per Section 09 90 00 – Painting and Section 09 97 00 – Special Coatings. All products applied to the concrete surfaces during the placement, finishing, and curing process shall be compatible with the painting or coating system as required by the manufacturer.

3.06 CONCRETE FINISH SCHEDULE

Item	Type of Finish
Concrete surfaces indicated to receive textured coating (as noted on Drawings and in Section 09 97 00 – Special Coatings)	I
Inner face of walls of tanks, flow channels, wet wells, perimeter walls, and miscellaneous concrete structures:	
From 1 feet below water surface to bottom of wall	I
From top of wall to 1 feet below water surface	II
Exterior concrete walls below grade	I
Exterior exposed concrete walls, ceilings, beams, manholes, hand holes, miscellaneous structures, and columns (including top of wall) to one foot below grade. All other exposed concrete surfaces not specified elsewhere	II
All interior exposed concrete walls and vertical surfaces	III
Interior exposed ceiling, including beams	III
Floors of process equipment tanks or basins, wetwells, flow channels and slabs to receive roofing material or waterproof membranes	B
All interior finish floors of buildings and structures and walking surfaces which will be continuously or intermittently wet	D or E
All interior finish floors of buildings and structures which are not continuously or intermittently wet	D
Floors to receive tile, resilient flooring, or carpeting	D
Exterior concrete sidewalks, steps, ramps, decks, slabs on grade and landings exposed to weather	E
Floors of process equipment tanks indicated on Drawings to receive micro-synthetic fiber reinforced grout topping	F
Garage, storage area floors, and loading docks	G

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Item	Type of Finish
Precast concrete form panels, hollow core planks, double tees	J

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 03 39 00
CONCRETE CURING

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Protect all freshly deposited concrete from premature drying and from the weather elements. The concrete shall be maintained with minimal moisture loss at a relatively constant temperature for a period necessary for the hydration of the cement and proper hardening of the concrete in accordance with the requirements specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03 11 00 – Concrete Formwork

B. Section 03 30 00 – Cast-In-Place Concrete

C. Section 03 35 00 – Concrete Finishes

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. ACI 301 – Specifications for Structural Concrete
2. ACI 304 – Guide for Measuring, Mixing, Transporting, and Placing Concrete
3. ACI 305.1 – Specification for Hot Weather Concreting
4. ACI 306.1 – Standard Specification for Cold Weather Concreting
5. ACI 308.1 – Specification for Curing Concrete
6. ASTM C171 – Standard Specifications for Sheet Materials for Curing Concrete
7. ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
8. ASTM C1315 – Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete

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1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures.

1. Proposed procedures for protection of concrete under wet weather placement conditions.

2. Proposed normal procedures for protection and curing of concrete.

3. Proposed special procedures for protection and curing of concrete under hot and cold weather conditions.

4. Proposed method of measuring concrete surface temperature changes.

5. Manufacturer's literature and material certification for proposed curing compounds.

PART 2 – PRODUCTS

2.01 LIQUID MEMBRANE-FORMING CURING COMPOUND

A. Clear curing and sealing compound shall be a clear styrene acrylate type complying with ASTM C 1315, Type 1, Class A with a minimum solids content of 30%. Moisture loss shall not be greater than 0.40 kg/m2 when applied at manufacturer’s recommended volume for square feet of area. Manufacturer’s certification is required.

1. Acceptable products are:

a. Super Diamond Clear VOX by the Euclid Chemical Company;

b. Or approved equal.

B. Where specifically approved by Engineer, on slabs to receive subsequent applied finishes, compound shall conform to ASTM C 309.

1. Acceptable products are:

a. “Kurez DR VOX” or “Kurez W VOX” by the Euclid Chemical Company;

b. Or approved equal.

2. Install in strict accordance with manufacturer’s requirements.

2.02 EVAPORATION REDUCER

A. Evaporation reducer shall be:

1. "MasterKure ER 50” by Master Builders Solutions;

2. "Euco-Bar" by Euclid Chemical Company;

3. Or approved equal.

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PART 3 – EXECUTION

3.01 PROTECTION AND CURING

A. All freshly placed concrete shall be protected from the elements, flowing water and from defacement of any nature during construction operations.

B. As soon as the concrete has been placed and horizontal top surfaces have received their required finish, provisions shall be made for maintaining the concrete in a moist condition for at least a 7-day period thereafter, except for high early strength concrete, for which the period shall be at least the first three days after placement. Horizontal surfaces shall be kept covered, and intermittent, and localized drying will not be permitted.

C. Walls that will be exposed on one side with either fluid or earth backfill on the opposite side shall be continuously wet cured for a minimum of seven days. Use of a curing compound will not be acceptable for applications of this type.

D. The Contractor shall use one of the following methods to ensure that the concrete remains in a moist condition for the minimum period stated above.

1. Ponding or continuous fogging or sprinkling.

2. Application of mats or fabric kept continuously wet.

3. Continuous application of steam (under 150°F).

4. Application of sheet materials conforming to ASTM C171.

5. If approved by the Engineer, application of a curing compound in accordance with Article 3.04 of this Section.

E. The Contractor shall keep absorbent wood forms wet until they are removed. After form removal, the concrete shall be cured by one of the methods in Paragraph 3.01D of this Article.

F. Any of the curing procedures used in Paragraph 3.01D of this Article may be replaced by one of the other curing procedures listed in Paragraph 3.01D of this Article after the concrete is one-day old. However, the concrete surface shall not be permitted to become dry at any time.

3.02 CURING CONCRETE UNDER COLD WEATHER CONDITIONS

A. Suitable means shall be provided for a minimum of 72 hours after placing concrete to maintain it at or above the minimum as placed temperatures specified in Section 03 30 00 – Cast-In-Place Concrete, for concrete work in cold weather. During the 72-hour

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period, the concrete surface shall not be exposed to air more than 20°F above the minimum as placed temperatures.

B. Stripping time for forms and supports shall be increased as necessary to allow for retardation in concrete strength caused by colder temperatures. This retardation is magnified when using concrete made with blended cements or containing fly ash or slag cement. Therefore, curing times and stripping times shall be further increased as necessary when using these types of concrete.

C. The methods of protecting the concrete shall be approved by the Engineer and shall be such as will prevent local drying. Equipment and materials approved for this purpose shall be on the site in sufficient quantity before the work begins. The Contractor shall assist the Engineer by providing holes in the forms and the concrete in which thermometers can be placed to determine the adequacy of heating and protection. All such thermometers shall be furnished by the Contractor in quantity and type which the Engineer directs.

D. Curing procedures during cold weather conditions shall conform to the requirements of ACI 306.

3.03 CURING CONCRETE UNDER HOT WEATHER CONDITIONS

A. When air temperatures exceed 85°F, the Contractor shall take extra care in placing and finishing techniques to avoid formation of cold joints and plastic shrinkage cracking. If ordered by the Engineer, temporary sunshades and/or windbreakers shall be erected to guard against such developments, including generous use of wet burlap coverings and fog sprays to prevent drying out of the exposed concrete surfaces.

B. Immediately after screeding, horizontal surfaces shall receive an application of evaporation reducer. Apply in accordance with manufacturer's instructions. Final finish work shall begin as soon as the mix has stiffened sufficiently to support the workmen.

C. Curing and protection of the concrete shall begin immediately after completion of the finishing operation. Continuous moist-curing consisting of method 1 or 2 listed in Paragraph 3.01D of this Section is mandatory for at least the first 24 hours. Method 2 may be used only if the finished surface is not marred or blemished during contact with the coverings.

D. At the end of the initial 24-hour period, curing and protection of the concrete shall continue for at least six (6) additional days using one of the methods listed in Paragraph 3.01D of this Section.

E. Curing procedures during hot weather conditions shall conform to the requirements of ACI 305.

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3.04 USE OF CURING COMPOUND

A. Curing compound shall be used only where specifically approved by the Engineer. Curing compound shall never be used for curing exposed walls with fluid or earth backfill on the opposite side. A continuous wet cure for a minimum of seven days is required for these applications. Curing compound shall not be used on surfaces exposed to water in potable water storage tanks and treatment plants unless curing compound is certified in accordance with ANSI/NSF Standard 61.

B. When permitted, the curing compound shall maintain the concrete in a moist condition for the required time, and the subsequent appearance of the concrete surface shall not be affected.

C. The compound shall be applied in strict accordance with the manufacturer's recommendations after water sheen has disappeared from the concrete surface and after finishing operations. Coverage rates for the curing and sealing compound shall be in strict accordance with manufacturer’s requirements for the specific type of finish required. For rough surfaces, apply in two directions at right angles to each other.

END OF SECTION

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SECTION 03 60 00

GROUT

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Furnish all materials, labor, and equipment required to provide all grout used in concrete work and as bearing surfaces for base plates, in accordance with the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03 30 00 – Cast-in-Place Concrete

B. Section 03 35 00 – Concrete Finishes

C. Section 03 39 00 – Concrete Curing

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. CRD-C 621 – Corps of Engineers Specification for Non-shrink Grout

2. ASTM C 33 – Standard Specification for Concrete Aggregates

3. ASTM C 109 – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch or 50 mm cube Specimens)

4. ASTM C 531 – Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts and Monolithic Surfacings

5. ASTM C 579 – Test Method for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfacings

6. ASTM C 827 – Standard Test Method for Early Volume Change of Cementitious Mixtures

7. ASTM C 1107 – Standard Specification for Packaged Dry, Hydraulic Cement Grout (Nonshrink)

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1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures.

1. Certified test results verifying the compressive strength and shrinkage and expansion requirements specified herein.

2. Manufacturer's literature containing instructions and recommendations on the mixing, handling, placement, and appropriate uses for each type of grout used in the work.

1.05 QUALITY ASSURANCE

A. Field Tests

1. Compression test specimens will be taken during construction from the first placement of each type of grout and at intervals thereafter as selected by the Engineer to ensure continued compliance with these Specifications. The specimens will be made by the Engineer or its representative.

   a. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed as specified in ASTM C 109 at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days, 28 days, and any additional times as appropriate.

   b. Compression tests and fabrication of specimens for epoxy grout will be performed as specified in ASTM C 579, Method B, at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days and any other time as appropriate.

2. The cost of all laboratory tests on grout will be borne by the Owner, but the Contractor shall assist the Engineer in obtaining specimens for testing. The Contractor shall be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications. The Contractor shall supply all materials necessary for fabricating the test specimens, at no additional cost to the Owner.

3. All grout, already placed, which fails to meet the requirements of these Specifications, is subject to removal and replacement at no additional cost to the Owner.

PART 2 – PRODUCTS

2.01 MATERIALS

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A. Cement Grout

1. Cement grout shall be composed of Portland Cement and sand in the proportion specified in the Contract Documents and the minimum amount of water necessary

to obtain the desired consistency. If no proportion is indicated, cement grout shall consist of one-part Portland Cement to three parts sand. Water amount shall be as required to achieve desired consistency without compromising strength requirements. White Portland Cement shall be mixed with the Portland Cement as required to match color of adjacent concrete.

2. The minimum compressive strength at 28 days shall be 4000 psi.

3. For beds thicker than 1-1/2 inch and/or where free passage of grout will not be obstructed by coarse aggregate, 1-1/2 parts of coarse aggregate having a top size of 3/8 inch should be added. This stipulation does not apply for grout being swept in by a mechanism. These applications shall use a plain cement grout without coarse aggregate regardless of bed thickness. Cement grout used for surfaces swept in by a mechanism shall also contain micro-synthetic fibers in accordance with Section 03 30 00 – Cast-in-Place Concrete.

4. Sand shall conform to the requirements of ASTM C33.

B. Non-Shrink Grout

1. Non-shrink grout shall conform to CRD-C 621 and ASTM C 1107, Grade B or C when tested at a max. fluid consistency of 30 seconds per CDC 611/ASTM C939 at temperature extremes of 45°F and 90°F and an extended working time of 15 minutes. Grout shall have a min. 28-day strength of 7,000 psi.

a. Non-shrink grout shall be:

1) "NS Grout" by the Euclid Chemical Company;

2) "Sikagrout 212" by Sika Corporation;

3) “Conspec 100 Non-Shrink Non-Metallic Grout” by Conspec;

4) “MasterFlow 928” by Master Builders Solutions;

5) Or approved equal.

C. Epoxy Grout

1. Epoxy grout shall be:

a. "Sikadur 32 Hi-Mod" by Sika Corporation;

b. "Duralcrete LV" by Tamms Industries;

c. “E3 Series" by Euclid Chemical;

d. “MasterEmaco ADH 1090 RS” by Master Builders Solutions;

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e. Or approved equal.

2. Epoxy grout shall be modified as required for each application with aggregate per manufacturer's instructions.

D. Epoxy Base Plate Grout

1. Epoxy base plate grout shall be:

a. “Sikadur 42, Grout-Pak” by Sika Corporation;

b. “MasterFlow 648” by Master Builders Solutions;

c. Or approved equal.

2.02 CURING MATERIALS

A. Curing materials shall be as specified in Section 03 39 00 – Concrete Curing for cement grout and as recommended by the manufacturer for prepackaged grouts.

PART 3 – EXECUTION

3.01 GENERAL

A. The different types of grout shall be used for the applications stated below unless noted otherwise in the Contract Documents. Where grout is called for in the Contract Documents which does not fall under any of the applications stated below, non-shrink grout shall be used unless another type is specifically referenced.

1. Cement grout shall be used for grout toppings and for patching of fresh concrete, when approved by the Engineer. Grout toppings swept in by equipment mechanisms shall contain micro-synthetic fibers as specified in Section 03 30 00 – Cast-in-Place Concrete.

2. Non-shrink grout shall be used for grouting beneath base plates of structural metal framing.

3. Epoxy grout shall be used for bonding new concrete to hardened concrete.

4. Epoxy base plate grout shall be used for precision seating of base plates including base plates for all equipment such as engines, mixers, pumps, vibratory and heavy impact machinery, etc.

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B. New concrete surfaces to receive cement grout shall be as specified in Section 03 35 00 – Concrete Finishes, and shall be cleaned of all dirt, grease, and oil-like films. Existing concrete surfaces shall likewise be cleaned of all similar contamination and debris, including chipping, or roughening the surface if a laitance or poor concrete is evident.

The finish of the grout surface shall match that of the adjacent concrete. Curing and protection of cement grout shall be as specified in Section 03 39 00 – Concrete Curing.

C. All mixing, surface preparation, handling, placing, consolidation, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.

D. The Contractor, through the manufacturer of a non-shrink grout and epoxy grout, shall provide on-site technical assistance upon request, at no additional cost to the Owner.

3.02 CONSISTENCY

A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the application. Dry pack consistency is such that the grout is plastic and moldable but will not flow.

3.03 MEASUREMENT OF INGREDIENTS

A. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurement shall not be allowed.

B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

3.04 GROUT INSTALLATION

A. Grout shall be placed quickly and continuously, shall completely fill the space to be grouted and be thoroughly compacted and free of air pockets. The grout may be poured in place, pressure grouted by gravity, or pumped. The use of pneumatic pressure or dry-packed grouting requires approval of the Engineer. For grouting beneath base plates, grout shall be placed from one side only and allowed to flow across to the open side to avoid air-entrapment.

END OF SECTION

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SECTION 04 01 20
MASONRY CLEANING

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Furnish all labor, materials, equipment and appliances required for the complete execution of Work as shown on the Drawings and specified herein.

B. Section includes the following:

1. Cleaning exposed masonry and concrete surfaces shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 04 05 13 – Masonry Mortaring

B. Section 04 21 13 – Brick Masonry

C. Section 04 22 23.23 – Prefaced Concrete Unit Masonry

D. Section 07 60 00 – Sheet Metal Flashing and Trim

E. Section 07 90 00 – Joint Fillers, Sealants and Caulking

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of these specifications, the Work shall conform to the applicable requirements of the following documents:

1. Brick Institute of America, "Technical Notes on Brick Construction"

1.04 SUBMITTALS

A. In accordance with the procedures and requirements set forth in Section 01 33 00 – Submittal Procedures, submit the following:

1. Manufacturer's data on each product to be used.

2. Manufacturer's recommendations and instructions.

3. Qualification data demonstrating conformance with requirements of Article 1.05 of this Section.

4. Restoration and cleaning program outlining proposed process, including protection of adjacent vegetation, water, structures, and other items not intended to be affected by this work.

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1.05 QUALITY ASSURANCE

A. Use only masonry restoration and cleaning firm to perform work. Firm shall have a minimum of five years of experience in masonry restoration and cleaning.

B. Prior to staring restoration and cleaning work, demonstrate the materials and methods to be used on nine square feet of each masonry, or concrete surface and in an inconspicuous area. After sample has been cleaned or restored, wait seven days after completion and reevaluate to determine any negative reactions prior to cleaning the remaining areas.

1.06 DELIVERY, STORAGE AND HANDLING

A. Delivery materials to job site in original unopened packages, with manufacturer's label indicating name, and description of contents.

B. Store materials off the ground in a clean, dry, well ventilated space and in accordance with manufacturer's recommendations.

PART 2 – PRODUCTS

2.01 MATERIALS / EQUIPMENT

A. Provide cleaners as manufactured by the following:

1. Sure Klean as manufactured by Prosoco, Inc., 16E Woodburn Avenue, Pinehill, NJ 08021

2. Or approved equal.

B. Cleaning Solutions are described in product terminology of Sure Klean. All products listed below and as referenced in Part 2.01.A of this Section shall be applied in accordance with manufacturers specifications:

1. Brick

a. Initial application cleaner: EK Restoration Cleaner (Neutral PH) or approved equal.

b. Second application cleaner: EK Restoration Cleaner (Neutral PH) or approved equal

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2. Prefaced Concrete Unit Masonry

   a. Initial application cleaner two (2) times of: Stand off poultice powder with Enviro Klean® OverCoat or approved equal.

   b. Second application cleaner: 766 Limestone and Masonry Pre-Wash or approved equal.

   c. Final application Cleaner: Limestone & Masonry Afterwash and EnviroKlean® BioKlean or approved equal.

2.02 ACCESSORIES

A. Provide masking products, plastic sheeting, canvas tarp, or other protective covers and mask required to protect adjacent surfaces, vehicles, and other objects not intended to be cleaned.

PART 3 – EXECUTION

3.01 EXAMINATION / PREPARATION

A. Protect persons, vehicles, vegetation, and surrounding structures and surfaces from injury resulting from cleaning and restoration.

B. Do not perform work during windy conditions which may spread cleaning and restoration products onto unprotected surfaces.

C. Build temporary protection covers at points of entrance and exit which must remain in operation during the course of restoration and cleaning.

D. Do not begin installation until substrates have been properly prepared.

E. Verify that surfaces to receive Work are structurally sound and fully intact.

F. Verify that new masonry or concrete has cured at least twenty-one (21) days prior to starting Work.

G. Verify that surfaces to receive Work have a neutral pH.

H. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

I. Adjacent Elements: Elements surrounding the Work of this Section, which shall include, but not be limited to, fixtures, fittings, finishing hardware, roof and roofing materials, and flashing, shall be protected from damage or disfiguration.

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J. Occupied Areas: Occupied areas shall be closed off from the Work of this Section by means of dustproof and weatherproof temporary partitions.

K. Verify that walls, masonry, architectural terra cotta, stonework, concrete, and mortar that have been treated with any form of chemical/acid wash are neutralized.

L. Verify that masonry, architectural terra cotta, stonework, concrete, and mortar units are structurally sound and fully intact.

M. Before application ascertain that the masonry walls have a neutral pH level or all warranties are void.

N. Alkali or efflorescence should be treated with proper neutralizing compounds as recommended by masonry supplier before application can begin.

O. Where present, treat alkali or efflorescence with a neutralizing agent recommended for the surface.

3.02 APPLICATION

A. Hydro-Air Rinsing

1. General:

a. An approved cleaning solution shall be applied to all exterior Masonry Cleaning of all surfaces only with the use of fiber brushes.

b. The cleaning solution shall be allowed to remain on the masonry cleaning material surfaces for sufficient time to loosen adhered grime and dirt.

c. The cleaning solution shall be removed by the Hydro-Air Rinsing method.

1) A wet blast of air and cold water shall be applied by means of a heavy-duty hose equipped with nozzles adapted to produce nozzle pressures one-hundred fifty (150) psi and fifteen to thirty (15-30) degree fan tip in accordance with manufactures specification.

d. The cleaning solution, dust, and loose particles of mortar shall be completely neutralized and removed by means of Hydro-Air Rinsing method.

e. All wood, metal, glass, and other materials shall be protected during the cleaning operations.

2. Apply second cleaner in accordance with manufactures specifications with a contact time of no less than thirty (30) minutes once the cleaning surface is complete, neutralized, and rinsed.

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3. Apply a final cleaner in areas designated on the Contract Drawings and as directed by the Engineer once sample areas have been approved for third cleaning.

B. Brick Cleaning:

1. Initial Application-EK Restoration Cleaner (Neutral PH) or approved equal. Follow application instructions:

a. Prewet surface with fresh water.

b. Apply cleaner using a brush or roller.

1) Gentle scrubbing application will improve results.

2) Applying with high pressure spray will drive the chemicals deep into the surface, making it difficult to rinse completely.

3) Surface discoloration may result.

c. Leave the cleaning solution on the surface for ten to twenty (10-20) minutes.

1) Heavy soiling or mineral deposits may require longer dwell times.

a) Caution: Do not let cleaning solution “dry in” to the masonry. If drying occurs, lightly wet treated surfaces with fresh water, and reapply the cleaner, gently scrubbing.

2) Gently scrub heavily soiled areas.

d. Rinse thoroughly with fresh water.

e. Repeat for second application.

C. Prefaced Concrete Unit Masonry Cleaning:

1. Initial cleaning shall be applied to all Prefaced Concrete Unit Masonry Work surfaces in areas as indicated on the Contract Documents, prior to Work of remediation as follows:

a. Always test each type of surface and stain for product compatibility and dwell-time before full-scale cleaning.

1) Test at air and surface temperatures similar to those expected for overall cleaning. Temperature affects product performance.

b. Mixing Procedures

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1) Pour poultice powder into a suitable mixing container. Use one (1) pound of dry powder for every three to four (3-4) square feet to be cleaned.

2) While mixing, slowly add enough water or cleaning additive to bring mix to a dry paste.

3) Gradually stir in more water or additive until poultice mix reaches desired troweling consistency.

c. Application Instructions shall follow manufacturer application instructions, including but not limited to, the following:

1) Apply the prepared poultice mix to the surface using a plasterer's trowel or paste extrusion equipment. Apply a uniform one-quarter (1/4)-inch (0.6 cm) coating.

2) Cover the poultice with Enviro Klean® OverCoat™ (or approved equal). Press the OverCoat™ (or approved equal) protective paper against poultice. It will cling to the surface. Tape/seal off edges of the paper.

3) Leave the covered poultice on the surface twelve to twenty-four (12-24) hours. In extreme humidity, dwell time can be extended to forty-eight (48) hours. Test for most effective dwell-time.

4) Remove OverCoat™ (or approved equal). If the poultice is still moist, let it dry completely.

5) Carefully scrape the dried poultice off the masonry. Using a stiff - fibered scrubbing brush and fresh water, thoroughly rinse the treated surface. Be sure to remove all traces of the poultice paste.

6) Let treated surfaces dry.

7) Repeat the poulticing operation as needed.

a) NOTE: In some areas, several applications may be required to completely extract soluble salts from the masonry. During poulticing operations, laboratory tests of salt levels should be conducted on the poultice clay removed. Initial application of poultice application shall be repeated and a second shall be taken to verify that extraction of soluble salts has been completed.

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d. Second Application: 766 Limestone and Masonry Prewash (or approved equal) shall follow manufacturer application instructions, including but not limited to, the following:

1) Always prewet the surface with clean water.

2) Apply a heavy coating to the surface using a brush or roller.

3) Let the product dwell on the surface thirty (30) minutes to two (2) hours.

a) Note: Longer dwell times may be required with lower temperatures. DO NOT LET MATERIAL DRY ON SURFACE.

4) Low-pressure rinse, making sure to flush each portion of the masonry surface with concentrated water pressure. If pressure-water rinsing equipment is not available, reapply prewash and scrub vigorously with stiff-bristled brush or scrubbing pad. Rinse thoroughly with fresh water.

5) The prewash penetrates into the masonry, and failure to remove the cleaner will result in an unsightly detergent residue. Application of Sure Klean® Restoration Cleaner, Limestone Restorer or Limestone & Masonry Afterwash (or approved equal) ensures complete removal of 766 Limestone & Masonry Prewash.

e. Final Application- Limestone and Masonry Afterwash (or approved equal) shall follow manufacturer application instructions including but not limited to the following:

1) Limestone and Masonry Afterwash (or approved equal) works as part of these two-part cleaning systems to completely restore and neutralize masonry surfaces.

2) Immediately after rinsing 766 Limestone and Masonry Prewash or BioKlean™ (or approved equal) from masonry surface, apply the prepared Afterwash (or approved equal) to the wet surface.

3) Let the Afterwash (or approved equal) dwell for three to five (3-5) minutes.

4) Pressure rinse from the bottom of the treated area to the top. Make sure to cover each portion of the masonry surface with a concentrated stream of water. To avoid streaking, keep wall surfaces immediately below area being cleaned running wet and free of cleaner rundown and residues.

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3.03 ADJUSTING / PROTECTION / CLEANUP

A. Protect installed products until completion of Project.

B. Protect shrubs, metal, wood trim, glass, asphalt, and other building hardware from overspray during application.

C. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

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SECTION 04 05 13

MASONRY MORTARING

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes properties, materials, and services necessary to complete masonry mortaring.

B. Section Includes:

1. Masonry mortaring as specified herein include, but are not limited to, portland cement, lime, sand, coarse aggregate, admixtures for use in mortar, and appurtenances.

2. Masonry mortaring shall be provided as indicated on the Contract Drawings, specified herein, or as required for a complete installation.

3. The Contractor shall implement practices and procedures to meet the Project's sustainability goals as identified in the Contract Documents. The Contractor shall ensure that the sustainability requirements of this Section are implemented to the fullest extent.

1.02 RELATED SECTIONS

A. Section 04 05 16 – Masonry Grouting

B. Section 04 05 19 – Masonry Anchorage and Reinforcing

C. Section 04 21 13 – Brick Masonry

D. Section 04 22 23.23 – Prefaced Concrete Unit Masonry

1.03 REFERENCES

A. ASTM C91 – Standard Specifications for Masonry Cement

B. ASTM C144 – Standard Specification for Aggregate for Masonry Mortar

C. ASTM C150 – Standard Specification for Portland Cement

D. ASTM C207 – Standard Specification for Hydrated Lime for Masonry Purposes

E. ASTM C270 – Standard Specification for Mortar for Unit Masonry

F. ASTM C595 – Standard Specification for Blended Hydraulic Cement

G. ASTM C91-05 – Standard Specification for Masonry Cement

H. ASTM C780 – Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry

I. ASTM C1329 – Standard Specification for Mortar Cement

J. NYSBC – Section BC 2103 Masonry Construction Materials, BC 2104 Construction

K. ACI/ASCE 530 – Building Code Requirements for Masonry Structures and Specification

1.04 QUALITY ASSURANCE

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

B. The Contractor shall engage an independent testing agency to conduct tests specified herein and as follows:

1. Mortar: Mortar tests shall be performed in accordance with ASTM C270.

C. Requirements of Regulatory Agencies: Wherever a fire-resistance classification is shown or scheduled for unit masonry construction (four [4]-hour, three [3]-hour and similar designations), proportion masonry mortar to comply with the requirements established by UL and other governing Authorities Having Jurisdiction at the Project Site.

1.05 SUBMITTALS

A. The Contractor shall submit the Shop Drawings for the approval of the Engineer. Submittals shall include, but not be limited to:

1. Product Data: Manufacturer’s specifications and installation instructions for proprietary materials.

2. Certificates: Notarized certificates that the following comply with the specified requirements:

a. Portland cement

b. Hydrated lime

c. Mortar aggregates

3. Design Mix: Certified design mix for mortar.

4. Test Results: Results of mortar tests as specified herein and as specified in referenced standards.

5. Samples:

   a. Each type of colored mortar in metal channels at least six (6)-inches long, showing the range of color that can be expected in the finished Work.

   b. Label samples to indicate type and amount of colorant used. Engineer's review will be for color only. Compliance with all other requirements is the responsibility of Contractor.

6. Schedule of locations where each mortar will be used in the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials:

1. Materials shall not be delivered to the Site before the time of installation.

2. Materials delivered and stored at the Site shall be from approved manufacturers and sources only.

3. Materials shall be delivered in sufficient quantities to allow continuity of the Work.

B. Storage of Materials:

1. Materials shall be stored in original, undamaged containers with manufacturer's labels and seals intact.

2. Cement shall be stored in weathertight containers that exclude moisture and contaminants.

3. Hydrated lime shall be stored in weathertight containers that exclude moisture and contaminants.

4. Aggregates shall be kept clean and free from other materials during transportation and handling. Aggregate shall be stockpiled in a manner to prevent segregation.

5. Damage to materials during storage shall be prevented primarily by minimizing the amount of time they are stored at the Site before being incorporated into construction systems.

C. Handling of Materials:

1. Materials shall be handled in such a manner to avoid damage or breakage.

2. Materials shall not be exposed to detrimental conditions or physical damage. Materials which are so exposed shall be removed from the Site and shall not be incorporated into the Work.

3. Materials shall be handled in such a manner as to prevent inclusion of contaminants.

4. Packages or containers shall not be opened until all preparatory Work is complete and installation is to begin immediately. Materials shall not be allowed to become wet or soiled or covered with ice or snow.

1.07 SYSTEM DESIGN REQUIREMENTS

A. Where questions of compliance with the requirements of this Section arise, the Sections for mortar properties shall take precedence over the Sections for mortar proportions.

B. No change shall be made in the proportions established for mortar approved under the Sections for mortar properties nor shall material with different physical characteristics be utilized in mortar used in the Work unless compliance with the Sections for mortar properties are re-established by Shop Drawing data submission to Engineer.

C. Two (2) different air-entraining materials shall not be combined in mortar.

D. Sustainable Design Requirements:

1. Recycled Content of Masonry Mortar Products: Postconsumer recycled content plus one-half (1/2) of preconsumer recycled content not less than fifteen percent (15%).

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers of Masonry mortar items are as follows:

1. Spec Mix, Inc., 1230 Eagan Industrial Road, Eagan, MN 55121

2. York Building Products, 5952 Lincoln Highway West, Thomasville, PA 17364

3. Edison Coatings, Inc., 3 Northwest Drive, Plainville, CT 06062

4. Or approved equal.

2.02 MATERIALS / EQUIPMENT

A. Portland Cement:

1. Provide Type I or III portland cement that conforms to the requirements of ASTM C150.

2. Provide non-staining portland cement of natural color or of the color required to be compatible with the required colored mortar pigment selected by Engineer.

B. Hydrated Lime: Provide Type S hydrated lime that conforms to the requirements of ASTM C207.

C. Sand for Mortar: Provide natural sand that conforms to the requirements of the following:

1. ASTM C144, except for joints less than one-quarter (1/4) inch use aggregate graded with one-hundred percent (100%) passing the No. 16 sieve.

2. White Mortar Aggregates: Provide natural white sand or ground white stone for portland cement lime mortars, as required for compatibility with mortar colors selected by Engineer.

3. Colored Mortar Aggregates: Provide ground marble, granite, or other sound stone, as required to match the sample approved by Engineer for portland cement lime mortars.

D. Coloring Additive: A mineral-oxide pigment, harmless to mortar set and strength shall be provided. Colors shall be as selected by the Engineer.

2.03 MIXES

A. Mortar: Provide mortar that conforms to the requirements of ASTM C270, except as modified herein, and of the type and colors specified.

1. Provide a cement-lime mortar; masonry cement mortars are not acceptable.

2. Calcium chlorides are not permitted.

3. Admixtures shall not be used unless specifically directed by these Sections.

2.04 MIXING

A. Measurement of Materials:

1. Cement and Hydrated Lime: Batched by the bag.

2. Sand: Batched by volume in suitably calibrated containers. Make allowance for bulking and consolidation, and for weight per cubic foot of contained moisture.

3. Proportion of Volumetric Mixtures: One ninety-four (94)-pound sack of portland cement and one 50-pound sack of hydrated lime constitute nominal one (1) cubic foot.

4. Shovel measurement: Not permitted.

B. Mortar:

1. All cementitious materials and aggregates shall be mixed between three and five (3-5) minutes in a mechanical batch mixer with a sufficient amount of water to produce a workable consistency. Mortar shall not be hand mixed.

2. When required, cement and pigment shall be mixed for colored mortar prior to mixing in mortar. The maximum percentage by weight of cement for pigment shall be limited to ten percent (10%).

3. Limit batch size to avoid retempering.

4. Mortar that has begun to stiffen or is not used within two (2) hours after initial mixing shall not be used.

5. The mixer drum shall be completely emptied before recharging the next batch.

C. Mortar Temperature:

1. Refer to Article 3.02.C of this Section for Environmental Condition requirements for masonry work

2. Antifreeze compounds or calcium chloride in mortars shall not be used to lower the freezing point or accelerate setting.

D. Proportions for Exterior Blockwork and Load-Bearing Masonry Back-Up: Type “S” as per ASTM C270 and shall have a flow suction greater than seventy-nine percent (79%) of the flow immediately after mixing when tested in accordance with ASTM C91.

1. Proportions by Volume: One (1) part portland cement to one-quarter to one-half (1/4 to 1/2) parts hydrated lime and not less than two and one-quarter (2-1/4) or more than three (3) times the sum of the volumes of cement and lime for the aggregate.

E. Proportions for pointing mortar.

1. Proportions by Volume: One (1) part portland cement to one-quarter (1/4) part hydrated lime and two (2) parts extra fine sand.

F. Admixtures: Added in accordance with approved manufacturer's instructions. The use of calcium chloride will not be permitted.

G. Additional requirement for mixing restoration mortars:

1. Ratio: Approximately four (4) parts dry material to one (1) part water: This ratio is approximate. Adjustments to the amount of water must be made according to local weather conditions. Excessive water will lighten the final color. Pointing mortar should be drier than setting mortar to help control color.

2. Add water to dry ingredients and mix well. Adjust amount of water according to the weather and the porosity of the substrate.

3. It is recommended that personal protective equipment be used during mixing in accordance with OSHA requirements. Do not mix more material than can be used within thirty (30) minutes. Discard any mixed material that has been unused for thirty (30) minutes or more.

H. Grout Materials: Grout materials shall be in accordance with Section 04 05 16 – Masonry Grouting.

I. Masonry Anchorage and Reinforcing: Masonry Anchorage and Reinforcing shall be in accordance with Section 04 05 19 – Masonry Anchorage and Reinforcing.

J. Prefaced Concrete Unit Masonry: Prefaced Concrete Unit Masonry shall be in accordance with Section 04 22 23.23 – Prefaced Concrete Unit Masonry.

PART 3 – EXECUTION

3.01 EXAMINATION / PREPARATION

A. Prior to placing mortar, remove laitance, loose aggregate, and any substance that may prevent mortar from bonding to the foundation.

3.02 APPLICATION

A. Installation of mortar shall be in accordance with the requirements of Section 04 21 13 – Brick Masonry.

B. Mortar Types: Unless otherwise indicated, use mortar as specified in Section 04 21 13 – Brick Masonry, and as follows:

1. Use Type S mortar for all wall types both interior and exterior exposure.

2. Type N mortar will not be accepted for use on the Project.

3. Use grout fill for structural requirements and for grouting reinforcing steel in unit masonry construction.

4. Do not use mortar which has begun to set or if more than one-half (1/2) hour has elapsed since initial mixing. Retemper mortar during the one-half (1/2) hour period only as required to restore workability.

C. Environmental Conditions:

1. Site Facilities: Supplemental heat sources, as may be required should the Contractor wish to continue unit masonry construction in cold weather, are not available at the Site. The provision and expense of all supplemental heat energy sources, fuel, and equipment is the responsibility of the Contractor.

2. Materials and surrounding air temperature shall be maintained at a minimum fifty (50) degrees Fahrenheit prior to, during, and seventy-two (72) hours after completion of masonry Work. Masonry shall not be erected when the ambient temperature is below thirty-two (32) degrees Fahrenheit with a rising or falling temperature, or when there is a probability of such a condition existing within forty-eight (48) hours, unless special provisions are made for heating the materials and protecting the Work from freezing. Work will not be permitted with or on frozen materials. Use of masonry units having a film of frost on their surfaces will not be permitted.

D. Reinforced Masonry Setting: Masonry for vertically reinforced masonry units shall be laid with core cells vertically aligned. Core cells shall be clear of mortar and unobstructed. Mortar shall be placed in masonry unit bed joints and shall be back one-fourth (1/4) inch from the edge of the unit grout spaces and beveled back and upward. Mortar shall be cured seven (7) days before placing grout.

1. Reinforcing: Concrete masonry unit cores shall be reinforced with reinforcement bars and grout as shown. Vertical reinforcement shall be in accordance with Section 04 05 19 – Masonry Anchorage and Reinforcing.

2. Grouting: Masonry unit surfaces in contact with grout shall be wetted just prior to grout placement. All grouting shall be in accordance with Section 04 05 16 – Masonry Grouting

3.03 FIELD TESTING / QUALITY CONTROL

A. Mortar shall be prepared and tested for preconstruction and construction evaluation in accordance with the requirements of ASTM C780. Specimens for construction

evaluation shall be prepared a minimum of every five-hundred (500) square feet of masonry construction.

B. Mixing: By mechanically operated batch mixer with a water control device having an indicator. Drum shall be entirely discharged before recharging. Mix sand, lime, cement, and admixtures dry for two (2) minutes minimum, add water and mix for an additional three (3) minutes minimum. Mix mortar with slightly less water than the maximum amount consistent with workability, to provide near maximum tensile bond strength. Mix only amount that can be used before initial set takes place, or within the first one-half (1/2) hour, and then only replace water lost by evaporation.

C. Mixers, wheelbarrows, mortar boards, etc., shall be kept clean.

D. Retempering of mortar will not be permitted and mortar that has been allowed to stand more than one (1) hour shall not be used.

E. Mortar shall be mixed and tempered on the mortar boards so to contain as much water as necessary at all times.

F. Mortar specified under this Section to be used for installation of Unit Masonry Work specified under Section 04 22 23.23 – Prefaced Concrete Unit Masonry and Section 04 05 19 – Masonry Anchorage and Reinforcing. Refer to Section 04 05 16 – Masonry Grouting for Work associated with masonry grout.

3.04 ADJUSTING / PROTECTION / CLEANUP

A. General: After mortar has set, new masonry Work shall be cleaned as follows:

1. All Masonry: All excess mortar and mortar smears shall be removed. Any defective mortar shall be removed and replaced, matching adjacent Work. Nonmetallic tools shall be used in all cleaning operations.

a. Burning: Do not burn demolished materials.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 04 05 16

MASONRY GROUTING

PART 1 – GENERAL

1.01 SUMMARY

A. Masonry grouting as specified herein include, but are not limited to, portland cement, lime, sand, pea stone aggregate, admixtures for use in masonry grout, and appurtenances.

B. Section Includes:

1. Masonry grout shall be provided as indicated on the Contract Drawings, specified herein, or as required for a complete installation.

2. The Contractor shall implement practices and procedures to meet the Project's sustainability goals as identified in the Contract Documents. The Contractor shall ensure that the sustainability requirements of this Section are implemented to the fullest extent.

1.02 RELATED SECTIONS

A. Section 04 05 13 – Masonry Mortaring

B. Section 04 05 19 – Masonry Anchorage and Reinforcing

C. Section 04 22 23.23 – Prefaced Concrete Unit Masonry

1.03 REFERENCES

A. ASTM C150 – Standard Specification for Portland Cement

B. ASTM C207 – Standard Specification for Hydrated Lime for Masonry Purposes

C. ASTM C404 – Standard Specification for Aggregates for Masonry Grout

D. ASTM C476 – Standard Specification for Grout for Masonry

E. ASTM C595 – Standard Specification for Blended Hydraulic Cement

F. ASTM C1019 – Standard Test Method for Sampling and Testing Grout

G. NYSBC – Section BC 2103 Masonry Construction Materials, BC 2104 Construction

H. ACI/ASCE 530.1 – Specifications for Masonry Structures

1.04 QUALITY ASSURANCE

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

B. The Contractor shall engage an independent testing agency to conduct tests specified herein and as follows:

1. Grout: Grout tests shall be performed in accordance with ASTM C1019.

C. Requirements of Regulatory Agencies: Wherever a fire-resistance classification is shown or scheduled for unit masonry construction (four [4]-hour, three [3]-hour and similar designations), proportion masonry grouts to comply with the requirements established by UL and other governing authorities having jurisdiction at the Project Site.

1.05 SUBMITTALS

A. The Contractor shall submit the Shop Drawings for the approval of the Engineer. Submittals shall include, but not be limited to:

1. Product Data: Manufacturer’s specifications and installation instructions for proprietary materials.

2. Certificates: Notarized certificates that the following comply with the specified requirements:

a. Portland cement

b. Hydrated lime

c. Grout aggregates

3. Design Mix: Certified design mix for grout.

4. Test Results: Results of grout tests as specified herein and as specified in referenced standards.

5. Samples:

a. Complete selection of standard and custom colors of epoxy grout used for pointing mortar, for final selection by Engineer.

b. Label samples to indicate type and amount of colorant used. Engineer's review will be for color only. Compliance with all other requirements is the responsibility of Contractor.

6. Construction: Weight slips for grout materials at time of delivery.

7. Schedule of locations where each grout type will be used in the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials:

1. Materials shall not be delivered to the Site before the time of installation.

2. Materials delivered and stored at the Site shall be from approved manufacturers and sources only.

3. Materials shall be delivered in sufficient quantities to allow continuity of the Work.

B. Storage of Materials:

1. Materials shall be stored in original, undamaged containers with manufacturers labels and seals intact.

2. Cement shall be stored in weathertight containers that exclude moisture and contaminants.

3. Hydrated lime shall be stored in weathertight containers that exclude moisture and contaminants.

4. Aggregates shall be kept clean and free from other materials during transportation and handling. Aggregate shall be stockpiled in a manner to prevent segregation.

5. Damage to materials during storage shall be prevented primarily by minimizing the amount of time they are stored at the Site before being incorporated into construction systems.

C. Handling of Materials:

1. Materials shall be handled in such a manner to avoid damage or breakage.

2. Materials shall not be exposed to detrimental conditions or physical damage. Materials which are so exposed shall be removed from the Site and shall not be incorporated into the Work.

3. Materials shall be handled in such a manner to prevent inclusion of contaminants.

4. Packages or containers shall not be opened until all preparatory Work is complete and installation is to begin immediately. Materials shall not be allowed to become wet or soiled or covered with ice or snow.

1.07 SYSTEM DESIGN REQUIREMENTS

A. Where questions of compliance with the requirements of this Section arise, the Sections for grout properties shall take precedence over the Section for grout proportions.

B. No change shall be made in the proportions established for grout approved under the Section for grout properties nor shall material with different physical characteristics be utilized in grout used in the work unless compliance with the Sections for mortar properties are re-established by Shop Drawing data submission to Engineer.

C. Two (2) different air-entraining materials shall not be combined in grout.

D. Sustainable Design Requirements:

1. Recycled Content of Mortar and Masonry Grout Products: Postconsumer recycled content plus one-half (1/2) of preconsumer recycled content not less than fifteen percent (15%).

E. Project-specific system/design requirements will be provided in the Contract Specifications, if necessary, to supplement requirements given herein or Contract Drawings.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers of masonry grout items are as follows:

1. Spec Mix, Inc., 1230 Eagan Industrial Road, Eagan, MN 55121

2. Glen-Gery, Glenwood Mason Supply Co., Inc., 4100 Glenwood Road, Brooklyn, NY 11210

3. Edison Coatings, Inc., 3 Northwest Drive, Plainville, CT 06062

4. Or approved equal.

2.02 MATERIALS / EQUIPMENT

A. Portland Cement:

1. Provide Type I or III portland cement that conforms to the requirements of ASTM C150.

2. Provide non-staining portland cement of natural color or of the color required to be compatible with the required colored mortar pigment selected by Engineer.

B. Hydrated Lime: Provide Type S hydrated lime that conforms to the requirements of ASTM C207.

C. Aggregates for Grout: Provide fine and coarse aggregates that conform to the requirements of ASTM C404, ASTM C476.

D. Water: Provide clean and potable water from approved sources.

2.03 MIXES

A. Grout: Provide grout that conforms to the requirements of ASTM C476, ASTM C404 for fine or coarse grout.

B. Fine grout shall be used for filling spaces with openings less than two (2) inches.

C. Course grout shall be used for filling spaces with openings greater than two (2) inches.

2.04 MIXING

A. Measurement of Materials:

1. Cement and Hydrated Lime: Batched by the bag.

2. Sand: Batched by volume in suitably calibrated containers. Make allowance for bulking and consolidation, and for weight per cubic foot of contained moisture.

3. Proportion of Volumetric Mixtures: One 94-pound sack of portland cement and one 50-pound sack of hydrated lime constitute nominal one (1) cubic foot.

4. Shovel measurement: Not permitted.

B. Gout Temperature:

1. Refer to Section 04 05 13 – Masonry Mortaring, Article 3.02.C, for Environmental Condition requirements for masonry Work.

2. Antifreeze compounds or calcium chloride in mortars shall not be used to lower the freezing point or accelerate setting.

C. Grout: Grout shall be mixed in accordance with the requirements of ASTM C476. It is required that personal protective equipment be used during mixing in accordance with OSHA requirements. Do not mix more material than can be used within thirty (30) minutes. Discard any mixed material that has been unused for thirty (30) minutes or more

PART 3 – EXECUTION

3.01 EXAMINATION / PREPARATION

A. Prior to placing grout, remove laitance, loose aggregate, and any substance that may prevent grout from bonding to the foundation.

3.02 APPLICATION

A. Installation of mortar shall be in accordance with the requirements of Section 04 05 13 – Masonry Mortaring.

B. Installation of epoxy grout shall be in accordance with the manufacturer's instructions and recommendations.

C. Grouting: Masonry unit surfaces in contact with grout shall be wetted just prior to grout placement. Spaces less than two (2) inches in width shall be grouted with fine grout using low lift grouting techniques. Spaces two (2) inches or greater in width shall be grouted with coarse grout using high or low lift grouting techniques. When grouting is stopped for more than one (1) hour, grout shall be terminated one and one-half (1 1/2) inches below top of upper masonry unit to form a positive key for subsequent grout placement.

D. Low Lift Grouting: The first lift of grout shall be placed to a height of sixteen (16) inches and then shall be rodded for grout consolidation. Subsequent lifts shall be placed in eight (8)-inch increments and rodded for grout consolidation.

3.03 FIELD TESTING / QUALITY CONTROL

A. Grout shall be prepared and tested for construction evaluation in accordance with the requirements specified in ASTM C1019 and NYSBC Section BC 2104. Specimens shall be prepared a minimum of every one-hundred (100) cubic feet of grout placed.

B. Grout specified under this Section to be used for installation of unit masonry Work specified under Section 04 22 23.23 – Prefaced Unit Masonry and Section 04 05 19 – Masonry Anchorage and Reinforcing. Refer to Section 04 05 13 – Masonry Mortaring for Work associated with masonry mortaring.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 04 05 19

MASONRY ANCHORAGE AND REINFORCING

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes, but is not limited to, reinforcement, anchorage, and all accessories and appurtenances associated with anchorage and reinforcing of masonry.

B. Section Includes:

1. Masonry Anchorage and Reinforcing as specified herein shall include, but not be limited to, reinforcement, anchorage, and all accessories and appurtenances.

2. Table 04 05 19 - 1: Masonry anchoring and reinforcing list

C. Related Sections

1. Section 04 05 13 – Masonry Mortaring

2. Section 04 05 16 – Masonry Grouting

3. Section 04 22 23.23 – Prefaced Concrete Unit Masonry

1.02 REFERENCES

A. ASTM A153/A153M – Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware

B. ASTM A276 – Standard Specification for Stainless Steel Bars and Shapes

C. ASTM A615/A615M – Standard Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement

D. ASTM C1354 – Standard Test Method for Strength of Individual Stone Anchorages in Dimension Stone

E. Masonry Standards Joint Committee (MSJC):

1. ACI 530/ASCE 5/TMS 402 – Building Code Requirements for Masonry Structures

2. ACI 530.1/ASCE 6/TMS 602 – Specification for Masonry Structures

F. NYSBC – New York State Building Code

1.03 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Wherever a fire-resistance classification is shown or scheduled for unit masonry construction (four [4]-hour, three [3]-hour, and similar designations) provide masonry accessories, masonry units, and unit masonry construction complying with the requirements established by UL and other governing authorities having jurisdiction at the Project Site.

B. Source Quality Control: Provide all metal sheet, wire, plate, and bar stock masonry accessories from the same manufacturer.

C. Sample Panel: The Contractor shall erect sample panel.

1. The sample panel shall include facing veneer, bond pattern, mortar color, tooled joints, insulation, reinforcing, and all masonry accessories and backup.

2. Upon approval, the sample panel shall remain in place for the duration of masonry construction and shall be used as a basis of comparison for all masonry Work.

3. After final approval of finished masonry Work by the Engineer, the Contractor shall demolish the sample panel, and shall perform all Site restoration Work.

4. Sample Panels: The Contractor shall erect a mock wall as indicated in the Contract Documents.

1.04 SUBMITTALS

A. The Contractor shall prepare and submit for approval catalog cuts, drawings, and reference materials in accordance with Section 01 33 00 – Submittal Procedures. Submittals shall include the following:

1. Test Reports: The Contractor shall submit material test reports or manufacturer's certificate of compliance for face brick, structural glazed brick, concrete masonry units, and glazed structural tile.

B. Working Drawings: Submit for approval the following:

1. Copies of manufacturer’s specifications and installation instructions for each masonry accessory required. Include data substantiating that materials comply with specified requirements.

2. Provide drawings and material schedules showing all dimensions and sizes of masonry accessories coordinated with unit masonry construction Work, and other Work in which masonry accessories will be embedded, be supported from, or restrain.

3. Indicate methods for identifying and coordinating, at the Site, the location and accurate placement of each masonry accessory in unit masonry construction as the Work progresses. Indicate by letter of transmittal that items which must be installed in the shop have been received in time for proper sequencing of the Work to avoid delays.

4. Masonry control joint locations and details.

5. Drawings showing the location, extent, and accurate configuration and profile of all items shown, specified, and required by this and other Sections to be built into the unit masonry construction as the Work progresses. Provide elevations drawn at one-quarter (1/4)-inch scale and all details drawn at one and one-half (1-1/2)-inch scale.

6. Drawings for fabrication, bending, and placement of reinforcing bars. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcing for unit masonry construction.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: All products and materials shall be delivered, stored, and handled as follows.

B. Delivery and Storage: Masonry Anchoring and Reinforcing materials delivered and stored at the Site shall be from approved manufacturers and sources only.

C. Manufactured materials, shall be delivered and stored in their original containers, plainly marked with identification of material and maker. Materials in broken containers, or in packages showing water marks or other evidence of damage, shall not be used and shall be removed from Site.

1.06 DESIGN REQUIREMENTS

A. Provide masonry accessories of sizes, dimensions, and configurations coordinated with unit masonry construction system component sizes, dimensions, and configurations.

B. Where continuous horizontal cavity wall reinforcement is specified as providing restraint for cavity wall insulation, coordinate dimensions with thickness of cavity wall insulation specified for proper clearances.

C. Where structural steel will be provided with fireproofing do not use welded-on channel slots. Coordinate required offset of welded-on wire ties with depth of fireproofing.

D. Structural elements of masonry shall conform to the requirements of ACI 530/ASCE 5/TMS 402 for materials and installation.

E. Masonry materials and installation shall conform to the requirements of ACI 530.1/ASCE 6/TMS 602.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Provide Masonry Anchoring and Reinforcing as manufactured by the following:

1. Hohmann and Barnard, 30 Rasons Court, Hauppauge, NY 11788

2. Wire-Bond Products, 400 Roundtree Road, Charlotte, NC 28217

3. Heckmann Building Products, Inc., 1501 N. 31st Avenue, Melrose Park, IL 60160-2911

4. Or approved equal.

B. Weeps as manufactured by the following:

1. Mortar Net, 541 South Lake Street, Gary, IN 46403, phone: 800-664-6638.

2. Archovations, Inc., PO Box 241, Hudson, WI 54016, (888) 436-2620.

3. Or approved equal

C. Cavity drainage mat as manufactured by the following:

1. CavClear Masonry Mat, Archovations, Inc., 701 Second St, Hudson, WI

2. Or approved equal.

2.02 MATERIALS / EQUIPMENT

A. Metal Accessories:

1. For interior walls and partitions, and as required to secure masonry to adjoining construction, the Contractor shall provide hot-dipped galvanized metal anchors, ties and reinforcements conforming to ASTM A153/A153M, Class B2 that are galvanized after cutting.

2. For exterior walls, the Contractor shall provide Type 316 stainless steel for anchors, anchor slots, ties, and horizontal reinforcement.

B. Deformed reinforcing bars shall conform to ASTM A615/A615M Grade 60.

C. Horizontal Joint Reinforcement: Horizontal reinforcing shall be two (2) inches less in width than the actual thickness of the wall or partition in which it is to be placed.

1. Exterior masonry cavity walls: Walls shall be reinforced horizontally with truss type, standard nine (9) gauge (0.148 inch) by nine (9) gauge (0.148). Reinforcing shall be spaced at sixteen (16)-inch centers vertically.

2. Solid interior or exterior masonry walls: Walls shall be reinforced horizontally with truss type, standard nine (9) gauge (0.148 inch) by nine (9) gauge (0.148 inch). Reinforcing shall be spaced at sixteen (16)-inch centers vertically.

3. Corners: Corners shall be reinforced with the same type as wall reinforcing, standard nine (9) gauge (0.148 inch) by nine (9) gauge (0.148 inch), spaced in the same course as the wall reinforcing.

4. Intersections: Intersections between walls and partitions shall be reinforced horizontally with same type as wall reinforcing, standard nine (9) gauge (0.148 inch) by nine (9) gauge 0 (.148 inch), spaced in the same course as the wall reinforcing.

D. Rebar Positioners: The Contractor shall provide vertical and horizontal rebar positioners spaced at forty-eight (48)-inch centers maximum.

E. Dovetail Anchors: Dovetail anchors shall be one-eighth (1/8)-inch by one (1)-inch by two (2)-inch with 3/16-inch diameter wire.

F. Rigid Anchors: Rigid steel anchors shall be one (1)-inch wide (minimum), 3/16-inch-thick, and eighteen (18) inches long between bent ends. Each end shall be bent down three (3) inches (minimum) into mortar filled masonry cells.

G. Partition Top Anchors: Provide stainless steel partition top anchors set into sash block and extend to bond beam. Partition top anchor rods shall be twelve (12)-inches long.

H. Column Anchors: Masonry shall be anchored to columns at sixteen (16)-inch centers with stainless steel anchors.

I. Metal Fastenings: Bolts, metal wall plugs, or other approved metal fastenings for securing items to masonry and elsewhere shall be provided and installed as necessary.

J. Weeps: Cellular vent 3/8” wide by 2 ½" high x 3 5/8” length. CellVent by Mortar Net or approved equal. Color to closely match mortar.

K. Cavity Drainage Mat: Fluid conducting, non-absorbent, mold and mildew resistant polymer mesh consisting of 100% recycled polymer with PVC binder. Thickness of actual air space minus tolerances recommended by manufacturer.

L. Mortar Materials: Mortar materials shall be in accordance with Section 04 05 13 – Masonry Mortaring

M. Grout Materials: Grout materials shall be in accordance with Section 04 05 16 – Masonry Grouting.

PART 3 – EXECUTION

3.01 EXAMINATION / PREPARATION

A. Leave openings for equipment, piping, ducts, and other items to be installed subsequent to starting of unit masonry construction. After installation of said items, complete unit masonry construction to match Work immediately adjacent to openings.

B. Use full size units without cutting wherever possible. Provide special unit masonry shapes for all transitions and intersections. Do not field-cut special shapes from regular unit masonry shapes or substitute other alternatives for the use of special unit masonry shapes.

3.02 APPLICATION

A. Build chases and recesses as shown or required by others. Provide not less than eight (8) inches of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses.

B. Placing and Bonding: Masonry Anchoring and Reinforcing units shall be placed in a full bed of mortar, with full head joints, and shall be uniformly jointed with other Work.

1. Mortar Removal: Excess mortar shall be removed as the installation progresses.

2. Corners and Intersections: Intersections and external corners shall be interlocked. Horizontal reinforcing shall be spliced at intersections and corners with a six (6)-inch overlap of side rods.

3. Adjustment: Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, mortar shall be removed and replaced with new mortar.

4. Control Joints: Nonload-bearing masonry partitions shall be isolated from vertical and horizontal structural framing members with control joints.

5. Placing Metalwork: Structural steelwork, bolts, anchors, inserts, plugs, ties, lintels, and miscellaneous metalwork specified in other Sections, shall be placed and built into position as the installation progresses.

6. Extent of Masonry: Masonry partitions and walls shall extend from the floor to the bottom of floor or roof construction above, unless otherwise indicated.

7. Bonding and Anchoring: Walls and partitions shall be structurally bonded or anchored to each other and to concrete walls, beams, columns, and wall and roof diaphragms. Nonload-bearing walls and partitions shall be anchored to construction above in a manner that provides appropriate lateral stability and vertical movement of floor and roof construction above.

8. Preparation for New Work: Unfinished masonry shall be stepped back for joining with new masonry. Toothing will not be permitted.

C. Horizontal Joint Reinforcement and Anchorages: Horizontal joint reinforcement and anchorages shall be constructed as follows:

1. Reinforcement Spacing: Horizontal joint reinforcement shall be spaced at a minimum of sixteen (16) inches on center, measured vertically.

2. Reinforcement Placing: Masonry joint reinforcement shall be placed in the first horizontal joint above and below openings. Reinforcement shall be extended a minimum of sixteen (16) inches on each side of openings. Joint reinforcement shall be placed continuously in the first joint below the top of all walls. Joint reinforcement ends shall be lapped a minimum of six (6) inches. Joints at corners and intersections shall be reinforced with strap anchors at sixteen (16)-inch centers.

3. Reinforce all walls with continuous horizontal joint reinforcement unless specifically noted or specified to be omitted.

D. Control Joints: Preformed control joint material shall be installed in continuous lengths. Butt and corner joints shall be sealed in accordance with manufacturer's instructions. Control joints shall be sized as indicated on the Contract Drawings. Horizontal joint reinforcement shall not continue through control joints.

E. Built-In Work: Metal door and window frames, fabricated metal frames, louvered openings, anchor bolts, pipes, ducts, conduits, plates, and items specified in other sections shall be built in as the Work progresses. Items shall be built in plumb and level. Frame voids shall be filled solid with grout. Adjacent masonry cores shall be filled with grout for a minimum of twelve (12) inches beyond the framed openings. Do not build in organic materials subject to deterioration.

F. Tolerances: Masonry Work shall meet the tolerances specified in ACI 530.1/ASCE 6-95/TMS 602.

G. Laying Masonry Walls, Lintels, and Bond Beams:

1. Provide masonry reinforcing for lintels and bond beams where shown and wherever openings of sixteen (16) inches or more are shown. Provide formed-in-place masonry lintels and bond beams. Temporarily support formed in place lintels and bond beams.

2. Unless otherwise shown, provide one horizontal No. 6 deformed reinforcing bar for each four (4) inches of wall thickness.

   a. For hollow masonry unit walls, use specially formed “U” shaped lintel and bond beam units with reinforcing bars placed as shown, filled with grout as specified in Section 04 05 16 – Masonry Grouting.

   b. Bond beams for interior walls are to place every fourteen (14)-feet vertical for eight (8)-inch thick, eighteen (18)-feet vertical for ten (10)-inch thick and twenty-four (24) feet vertical for twelve (12)-inch thick and, at the second course below the top of walls. Partition top anchors shall extend past top sash block to bond beam set at second course below top of walls.

   c. Bond beams shall be provided above and below all wall openings. Where lintels beams are required provide bond beam directly above the lintel.

H. Setting Reinforced Masonry: Masonry for vertically reinforced masonry units shall be laid with core cells vertically aligned. Core cells shall be clear of mortar and unobstructed. Mortar shall be placed in masonry unit bed joints and shall be back one-fourth (1/4) inch from the edge of the unit grout spaces and beveled back and upward. Mortar shall be cured seven (7) days before placing grout.

I. Reinforcing: Concrete masonry unit cores shall be reinforced with reinforcement bars and grout as shown. Vertical reinforcement shall be kept in position using rebar positioners at top and bottom of cells and at intervals not exceeding forty-eight (48) inches. Reinforcement shall be spliced in accordance with ACI 530/ASCE 5-95/TMS 402, but splice lap shall be not less than twenty-four (24) bar diameters.

J. Cavity Drainage Mat: Install cavity drainage mat in air-space between insulation and masonry and stone veneer construction for full height of cavity. Verify that air space width is no more than 3/8 inch greater than masonry mat thickness. Install horizontally between joint reinforcement. Stagger end joints in adjacent rows. Use multiple layers at bottom of wall and above through-wall flashings when air space depth exceeds masonry mat thickness by more than 3/8 inch. Extend extra mat at least to top of base flashing. Butt adjacent pieces to moderate contact. Fit to perimeter construction and penetrations without voids. Cavity drainage mat shall be installed in accordance with manufacturer’s instructions.

K. Masonry Mortaring shall be in accordance with Section 04 05 13 – Masonry Mortaring.

L. Grouting shall be in accordance with Section 04 05 16 – Masonry Grouting.

3.03 FIELD TESTING / QUALITY CONTROL

A. Sample Panel: Masonry Anchoring and Reinforcing Work shall not be started until the specified sample panel has been approved. The sample panel shall be used as a standard for comparison of masonry Work. Sample panel shall be destroyed only after all masonry Work has been completed and approved by the Engineer.

3.04 ADJUSTING / PROTECTION / CLEANUP

A. Protection: At all times, surfaces of masonry on which Work is not being performed shall be protected. When rain or snow is imminent, and Work is discontinued, tops of exposed masonry walls and similar surfaces shall be covered with a strong waterproof membrane, well secured in place.

END OF SECTION

Table 04 05 19 - 1: Masonry Anchoring And Reinforcing List

The following materials model numbers are per Hohmann and Barnard, the contractor is not limited to Hohmann and Barnard as the manufacturer of these products.

MATERIALS	LOCATION	DESCRIPTION
170-2X-SH Lox-All Adjustable Horizontal Joint Reinforcement-Truss Type Eye-Wire with 2X- Seismic Hook (nine [9] ga)	Exterior masonry cavity walls with masonry veneer	Size the lengths to extend to within one (1) inch of outside face of outer wythe and within one (1) inch of outer face of inner wythe
Tie-HVR-195V Anchor System Adjustable Horizontal Joint Reinforcement-Truss Type Flexible Wire Ties with Vertical J-Hook (nine [9] ga)	Exterior masonry cavity walls with stone veneer and bluestone wainscot sill	Size the lengths to extend to within one (1) inch of outside face of outer wythe and within one (1) inch of outer face of inner wythe
#120 Horizontal Joint Reinforcement-Truss type (nine [9] ga)	Solid interior masonry walls: single wythe interior walls with collar joints.	Two (2)-inches less in width than the actual thickness of the partition. Corners and intersections shall be reinforced with the same type as wall reinforcing
#140 Horizontal Joint Reinforcement-Truss type (nine [9] ga)	Solid interior masonry walls: multi wythe interior walls with collar joints.	Two (2)-inches less in width than the actual thickness of the partition. Corners and intersections shall be reinforced with the same type as wall reinforcing
Lox-All #180 TJ Dub'l Loop-Lok Truss with #120 Horizontal Joint Reinforcement-Truss type (nine [9] ga)	Interior masonry chase walls with a separation of four (4) inches to ten (10) inches with collar joints.	Size the lengths to extend to within one (1) inch of outside face of outer wythe
#Spyra-Lox Rebar-Joint Tie (nine [9] ga.) galvanized	For overlap and placement of rebars	Conform to overlap requirement Size ties to rebar size as to accommodate varying overlap requirements
#315-BL Flexible Dovetail Wire Tie (one-fourth [1/4]-inch) with Continuous Wire (nine [9] ga.) and #305 Dovetail Slot	Whenever masonry abuts concrete walls or framework	Size the lengths to extend to within one (1) inch of outside face of outer wythe
#PTA-310 - Partition Top Anchors	Anchorage to concrete slab and beams	Use with a sash block. Insert twelve (12)-inch long anchor to engage bond beam set below.
#PTA-420 - Partition Top Anchors	Anchorage to existing concrete slab and beams and or steel beam flanges. Use with a sash block	Use with a sash block. Insert twelve (12)-inch long anchor to engage bond beam set below.
#- RB &RB -Twin Re-Positioners, nine (9) ga Hot dipped galvanized	For all reinforcing place filled GFB or CMU cores.	Size according to masonry unit thickness

SECTION 04 21 13

BRICK MASONRY

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes, but is not limited to, brick masonry units, and all accessories and appurtenances associated with brick masonry Work.

B. Section Includes:

1. The Contractor shall provide all labor, material, equipment, and incidentals as shown, specified and required to furnish and install Unit Masonry in accordance with the requirements of this section.

2. There is one type of brick to match for the work as follows:

a. Matching brick of the existing mechanical screen building.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 04 05 13 – Masonry Mortaring

B. Section 04 05 16 – Masonry Grouting

C. Section 04 05 19 – Masonry Anchorage and Reinforcing

D. Section 04 22 23.23 – Prefaced Concrete Unit Masonry

E. Section 07 60 00 – Sheet Metal Flashing and Trim

F. Section 07 90 00 – Joint Fillers, Sealants and Caulking

G. Section 07 95 00 – Expansion Joint System

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. ASTM C216 – Standard Specification for Facing Brick

B. ASTM A153/A153M – Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware

C. ASTM A615/A615M – Standard Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement

D. Masonry Standards Joint Committee (MSJC):

1. ACI 530/ASCE 5/TMS 402 – Building Code Requirements for Masonry Structures

2. ACI 530.1/ASCE 6/TMS 602 – Specification for Masonry Structures

E. NYSBC – New York State Building Code

1.04 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Wherever a fire-resistance classification is shown or scheduled for unit masonry construction (four [4]-hour, three [3]-hour, and similar designations), provide masonry accessories, masonry units and unit masonry construction complying with the requirements established by UL and other governing authorities having jurisdiction at the Project Site.

B. Source Quality Control: Provide all metal sheet, wire, plate, and bar stock masonry accessories from the same manufacturer.

C. Sample Panel: The Contractor shall erect sample panel.

1. The sample panel shall include facing veneer, bond pattern, mortar color, tooled joints, control joints, insulation, reinforcing, all masonry accessories and backup.

2. Upon approval, the sample panel shall remain in place for the duration of masonry construction and shall be used as a basis of comparison for all masonry Work.

3. After final approval of finished masonry Work by the Engineer, the Contractor shall demolish the sample panel, and shall perform all Site restoration Work.

D. Job Mock-ups: Prior to installation of unit masonry Work, but after Engineer's approval of samples, erect job mock-ups using materials, pattern bond and joint tooling shown or specified for final Work. Build mock-ups at the Site, in location approved by the Engineer. Indicate the proposed range of color, texture, and workmanship to be expected in the completed Work in each area of the Work. Obtain Engineer's acceptance of visual qualities of the mock-ups before start of masonry Work. Retain and protect mock-ups during construction as a standard for judging completed masonry Work. Do not alter, move, or destroy mock-ups until given written permission by Engineer. Masonry construction that does not meet the standards approved on the job mock-ups shall be removed and rebuilt as required by Engineer. Provide mock-ups of the portions of the unit masonry partition intersection showing all special shapes to be used in the Work.

1.05 SUBMITTALS

A. The Contractor shall prepare and submit for approval catalog cuts, drawings, and reference materials in accordance with Section 01 33 00 – Submittal Procedures. Submittals shall include the following:

1. Samples: The Contractor shall submit three (3) samples each of face brick that are representative of the full range of color, shading and texture of the material to be provided as a match to the existing materials.

2. Copies of the manufacturer's test data for all masonry materials required, including certification that materials comply with the specified requirements. Include instructions for handling, storage, installation and protection of materials.

3. Test Reports: The Contractor shall submit material test reports or manufacturer's certificate of compliance for face brick.

B. Working Drawings: Submit for approval the following:

1. Copies of manufacturer’s specifications and installation instructions for each masonry accessory required. Include data substantiating that materials comply with specified requirements.

2. Provide drawings and material schedules showing all dimensions and sizes of masonry accessories coordinated with unit masonry construction Work, and other Work in which masonry accessories will be embedded, be supported from, or restrain.

3. Indicate methods for identifying and coordinating, at the Site, the location and accurate placement of each masonry accessory in unit masonry construction as the Work progresses. Indicate by letter of transmittal that items which must be installed in the shop have been received in time for proper sequencing of the Work to avoid delays.

4. Complete layout of all unit masonry walls showing modular planning and all special shapes to be used in the Work. Show all details for each condition encountered in the Work. Provide plan and elevation views drawn at one-quarter (1/4)-inch scale and details drawn at one and one-half (1 1/2)-inch scale. Show all items required to be built into unit masonry construction.

5. Masonry control joint locations and details.

6. Drawings showing the location, extent, and accurate configuration and profile of all items shown, specified, and required by this and other Sections to be built into the unit masonry construction as the Work progresses. Provide elevations drawn at one-quarter (1/4)-inch scale and all details drawn at one and one-half (1-1/2)-inch scale.

7. Drawings for fabrication, bending, and placement of reinforcing bars. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcing for unit masonry construction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. General: All products and materials shall be delivered, stored, and handled as follows.

B. Delivery and Storage: Brick Masonry materials delivered and stored at the Site shall be from approved manufacturers and sources only.

C. Masonry Units:

1. Masonry units shall be handled in a manner which prevents undue breakage or chipping.

2. Brick Masonry shall be unloaded using brick clamps.

3. All masonry units shall be stored on platforms under shelter or in another approved manner so as to protect these materials from soil and weather.

D. Rejection: Brick Masonry that is warped, cracked, or of inferior quality will be rejected. Such items shall be removed from the Site and not offered again for inspection.

E. Manufactured materials shall be delivered and stored in their original containers, plainly marked with identification of material and maker. Materials in broken containers or in packages showing water marks or other evidence of damage shall not be used and shall be removed from Site.

1.07 DESIGN REQUIREMENTS

A. Provide masonry accessories of sizes, dimensions, and configurations coordinated with unit masonry construction system component sizes, dimensions, and configurations.

B. Where continuous horizontal cavity wall reinforcement is specified as providing restraint for cavity wall insulation, coordinate dimensions with thickness of cavity wall insulation specified for proper clearances.

C. Where structural steel will be provided with fireproofing do not use welded-on channel slots. Coordinate required offset of welded-on wire ties with depth of fireproofing.

D. Brick Masonry Units: Limit total moisture absorption until time of installation to the maximum percentage specified for the average annual relative humidity as reported by the United States Weather Bureau Station nearest the Site and the corresponding percentage of total linear drying shrinkage of the Brick masonry units.

E. Comply with ASTM C90 Climatic Map establishing criteria for percent annual mean relative humidity.

F. Structural elements of masonry shall conform to the requirements of ACI 530/ASCE 5/TMS 402 for materials and installation.

G. Masonry materials and installation shall conform to the requirements of ACI 530.1/ASCE 6/TMS 602.

H. Contractor shall provide masonry and other appurtenances as shown on the Contract Drawings and specified herein. The Work also includes:

1. Providing openings in masonry to accommodate the Work under this and other Sections and building into the masonry all items such as sleeves, anchor bolts, inserts and all other items to be embedded in or penetrate the new or existing masonry for which placement is not specifically provided under other Sections.

2. Providing openings in new and existing masonry to accommodate the Work under other contracts and assisting other contractors in building into the new and existing masonry all items such as sleeves, anchor bolts, inserts and all other items required to be embedded in or penetrate the masonry under other contracts.

I. Coordination:

1. Review installation and demolition procedures under other contract specifications and contracts and coordinate them with the Work specified herein.

2. Notify other contractors in advance of the installation of the Work included herein to provide them with sufficient time for the installation, demolition, and coordination of interrelated items that are included in their contracts and that must be installed or demolished in conjunction with the Work included in this Section.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers shall be listed as below.

1. Face Brick and Common Brick:

a. Glen Gery Hanley Plant, Summerville, PA

b. Bowerston Brick Company, Bowerston, OH

c. Meridian Brick, Ashland, VA

d. Or approved equal

2.02 MATERIALS / EQUIPMENT

A. Face Brick:

1. Bricks shall match existing bricks in colors, shape, texture, sheen, and dimension. Basis of Design:

    a. Glen Gery White Plains Blend by Consolidated Brick. Contact: Rocco Maggio, 1-800-321-0021 x7222.

2. Provide brick complying with ASTM C216, Grade SW Type FBS for all brick exposed to weather.

3. Special Shapes: Provide the following to match existing or restored brick:

    a. Lintels, bond beams, reinforcing units, and flush-end reinforcing units, interior and exterior corner shapes, solid jambs, sash block, coves, premolded control joint blocks, headers, and other special conditions.

    b. Provide square edge block for horizontal and vertical outside corners, except where shown as bullnose.

    c. End blocks at all locations where masonry walls abut concrete, or steel columns to facilitate installation of compressible filler, backer rod, and sealant or fire-rated fire stop sealant systems, if required.

    d. Special shape units shall conform to the applicable provisions of the units with which they are used.

B. Masonry Anchorage and Reinforcing: Masonry Anchorage and Reinforcing shall be in accordance with Section 04 05 19 – Masonry Anchorage and Reinforcing.

C. Mortar Materials: Mortar materials shall be in accordance with Section 04 05 13 – Masonry Mortaring.

D. Grout Materials: Grout materials shall be in accordance with Section 04 05 16 – Masonry Grouting.

E. Joint Seals: Joint seal materials shall be in accordance with Section 07 90 00 – Joint Fillers, Sealants, and Caulking.

F. Refer to Section 04 05 19 – Masonry Anchorage and Reinforcing for reference to weep vent. Provide weeps at base flashing.

PART 3 – EXECUTION

3.01 EXAMINATION / PREPARATION

A. It is required that personal protective equipment be used for all masonry Work in accordance with OSHA requirements. Do not mix more material than can be used within

thirty (30) minutes. Discard any mixed material that has been unused for thirty (30) minutes or more.

B. Leave openings for equipment, piping, ducts, and other items to be installed subsequent to starting of unit masonry construction. After installation of said items, complete unit masonry construction to match Work immediately adjacent to openings.

C. Use full size units without cutting wherever possible. Provide special unit masonry shapes for all transitions and intersections. Do not field-cut special shapes from regular unit masonry shapes or substitute other alternatives for the use of special unit masonry shapes.

D. Environmental Conditions: Refer to Section 04 05 13 – Masonry Mortaring, Article 3.02.C, for Environmental Condition requirements for masonry Work.

3.02 APPLICATION

A. Coursing: Masonry walls shall be carried up level and plumb all around. Do not carry up one section of the walls in advance of the others, unless specifically approved. Heights of masonry shall be checked with an instrument at each floor, and at sills and heads of openings, to maintain the level of walls. Masonry courses shall be maintained to a uniform dimension. Vertical and horizontal joints shall be formed to a uniform thickness. Brick masonry units shall be laid in running bond and in solder coursing above window openings to match existing. One (1) unit and one (1) mortar joint shall be coursed to equal eight (8) inches. Mortar joints shall be tooled to be concave.

B. Placing and Bonding: Masonry units shall be placed in a full bed of mortar, with full head joints, and shall be uniformly jointed with other Work.

1. Mortar Removal: Excess mortar shall be removed as the installation progresses.

2. Corners and Intersections: Intersections and external corners shall be interlocked. Horizontal reinforcing shall be spliced at intersections and corners with a six (6)-inch overlap of side rods.

3. Adjustment: Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, mortar shall be removed and replaced with new mortar.

4. Cutting: Job Site cutting of exposed masonry units shall be performed with power masonry saws to provide straight, clean, unchipped edges. Broken masonry unit corners or edges shall not be allowed.

5. Flush Joints: Mortar joints shall be cut flush where ceramic wall tile is to be installed.

6. Control Joints: Nonload-bearing masonry partitions shall be isolated from vertical and horizontal structural framing members with control joints.

7. Placing Metalwork: Structural steelwork, bolts, anchors, inserts, plugs, ties, lintels, and miscellaneous metalwork specified in other Sections shall be placed and built into position as the installation progresses.

8. Extent of Masonry: Masonry partitions and walls shall extend from the floor to the bottom of floor or roof construction above, unless otherwise indicated.

9. Bonding and Anchoring: Walls and partitions shall be structurally bonded or anchored to each other and to concrete walls, beams, columns, and wall and roof diaphragms. Nonload-bearing walls and partitions shall be anchored to construction above in a manner that provides appropriate lateral stability and vertical movement of floor and roof construction above.

10. Preparation for New Work: Unfinished masonry shall be stepped back for joining with new masonry. Toothing will not be permitted.

C. Horizontal Joint Reinforcement and Anchorages: shall be in accordance with Section 04 05 19 – Masonry Anchorage and Reinforcing.

D. Control Joints: Preformed control joint material shall be installed in continuous lengths. Butt and corner joints shall be sealed in accordance with manufacturer's instructions. Control joints shall be sized as indicated on the Contract Drawings. Horizontal joint reinforcement shall not continue through control joints.

E. Built-In Work: Metal door and window frames, fabricated metal frames, louvered openings, anchor bolts, pipes, ducts, conduits, plates, and items specified in other sections shall be built in as the Work progresses. Items shall be built in plumb and level. Frame voids shall be filled solid with grout. Adjacent masonry cores shall be filled with grout for a minimum of twelve (12) inches beyond the framed openings. Do not build in organic materials subject to deterioration.

F. Tolerances: Masonry Work shall meet the tolerances specified in ACI 530.1/ASCE 6-95/TMS 602.

1. Variation from Plumb: For lines and surfaces of columns, walls, and rises, do not exceed one-quarter (1/4) inch in ten (10) feet, or three-eighths (3/8) inch in a story height or twenty (20) feet maximum, nor one-half (1/2) inch in forty (40) feet or more. Except for external corners, expansion joints and other conspicuous lines, do not exceed one-quarter (1/4) inch in any story or twenty (20) feet maximum, nor one-half (1/2) inch in forty (40) feet or more.

2. Variation from Level: For lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed one-quarter (1/4) inch in any

bay or twenty (20) feet maximum, nor three-quarters (3/4) inch in forty (40) feet or more.

3. Variation of Linear Building Line: For position shown in Contract Drawings and related portion of columns, walls and partitions, do not exceed one-half (1/2) inch in any bay or twenty (20) feet maximum, nor three-quarters (3/4) inch in forty (40) feet or more.

4. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed plus or minus one-quarter (1/4) inch.

G. Cutting and Fitting: Masonry shall be cut and fit for chases, pipes, conduit, sleeves, grounds, and other items specified elsewhere. The Work shall be coordinated to provide correct size, shape, and location.

H. Waterproofing Course: A waterproofing course of flashing as specified in Section 07 60 00 – Sheet Metal Flashing and Trim shall be provided where shown, and at the following locations: at the bottom of masonry walls, at points where roofs adjoin exterior masonry walls, at lintels, below louver sills and window sills, under architectural coping and at other locations shown on the Contract Drawings.

I. Laying Masonry Walls, General: Lay out walls in advance for accurate spacing of surface pattern bond with uniform joint widths and to properly locate openings, masonry control joints, returns and offsets. Avoid the use of less than half size units at corners, jambs and wherever possible at other locations.

1. Lay up walls plumb and true to comply with specified tolerances, with courses level, accurately spaced and coordinated with other Work.

2. Provide minimum bearing at each jamb, of four (4) inches for openings less than six (6) feet zero (0) inches wide, and eight (8) inches for wider openings.

3. On concrete and clay unit masonry walls where pattern bond remains visually exposed, increase minimum bearing of masonry lintels to maintain continuity of joint pattern of wall and install so as to be indistinguishable from surrounding masonry.

J. Collar Joints:

1. Fill the vertical space between wythes solidly with mortar by parging the in place wythe and shoving units into the parging, for the locations by not limited to the following:

2. All exterior and interior and or multi wythe (except do not fill cavity of cavity wall construction) walls and partitions.

K. Mortar Color and Texture:

1. Lay all concrete unit masonry using mortar of natural color.

2. Lay all glazed structural tile and filled ground face concrete unit masonry Work using mortar of natural color. Rake as specified to receive pointing mortar.

L. Hand select ground face masonry units to assure uniform continuity of finished surfaces from unit to unit.

M. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point up all joints at corners, openings, and adjacent Work to provide a neat, uniform appearance, properly prepared for application of sealant compounds.

N. Environmental Conditions:

1. Site Facilities: Supplemental heat sources, as may be required should the Contractor wish to continue unit masonry construction in cold weather, are not available at the Site. The provision and expense of all supplemental heat energy sources, fuel, and equipment is the responsibility of the Contractor.

O. Masonry Mortaring shall be in accordance with Section 04 05 13 - Masonry Mortaring.

P. Grouting shall be in accordance with Section 04 05 16 - Masonry Grouting.

3.03 FIELD TESTING / QUALITY CONTROL

A. Sample Panel: Masonry Work shall not be started until the specified sample panel has been approved. The sample panel shall be used as a standard for comparison of masonry Work. Sample panel shall be destroyed only after all masonry Work has been completed and approved by the Engineer.

B. Remove and replace masonry units that are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

3.04 ADJUSTING / PROTECTION / CLEANUP

A. General: After mortar has set, new masonry Work shall be cleaned as follows:

1. All masonry: All excess mortar and mortar smears shall be removed. Any defective mortar shall be removed and replaced, matching adjacent Work. Nonmetallic tools shall be used in all cleaning operations.

2. Brick: Brickwork areas to be cleaned shall be soaked with water, then scrubbed, followed by a rinse with clean water. Fiber brushes shall be used to apply the cleaning solution and to wash the brickwork. Do not allow the acid solution to

come in contact with metalwork, blockwork and stonework below the area being cleaned shall be kept wet during the cleaning process. Cleaning product shall be Sure Klean Vana Trol Cleaner (dilution one [1] to four [4]) as manufactured by Prosoco or approved equal.

B. Protection: At all times, surfaces of masonry on which Work is not being performed shall be protected. When rain or snow is imminent, and Work is discontinued, tops of exposed masonry walls and similar surfaces shall be covered with a strong waterproof membrane, well secured in place.

C. Protection of Finished Work: Protective boards shall be provided at exposed external corners susceptible to damage by construction activities, without damaging completed Work.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 04 22 23.23

PREFACED CONCRETE UNIT MASONRY

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes, but is not limited to, all Work associated with prefaced concrete unit masonry.

B. Section Includes:

1. Prefaced Concrete Unit as specified herein shall include, but not be limited to, filled ground faced concrete masonry units, and all accessories and appurtenances.

C. Related Sections

1. Section 04 05 13 – Masonry Mortaring

2. Section 04 05 16 – Masonry Grouting

3. Section 04 05 19 – Masonry Anchorage and Reinforcing

4. Section 07 60 00 – Sheet Metal Flashing and Trim

1.02 REFERENCES

A. ASTM A153/A153M – Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware

B. ASTM A615/A615M – Standard Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement

C. ASTM C90 – Standard Specification for Loadbearing Concrete Masonry Units

D. ASTM C744-08 – Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units

E. ASTM C1262 – Standard Test Method for Evaluating the Freeze-Thaw Durability of Dry-Cast Segmental Retaining Wall Units and Related Concrete Units

F. ASTM E514/E514M – Standard Test Method for Water Penetration and Leakage Through Masonry

G. Masonry Standards Joint Committee (MSJC):

1. ACI 530/ASCE 5/TMS 402 – Building Code Requirements for Masonry Structures

2. ACI 530.1/ASCE 6/TMS 602 – Specification for Masonry Structures

H. NYSBC – New York State Building Code.

1.03 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Wherever a fire-resistance classification is shown or scheduled for unit masonry construction (four [4]-hour, three [3]-hour, and similar designations), provide masonry accessories, masonry units and unit masonry construction complying with the requirements established by Underwriters Laboratories (UL) and other governing authorities having jurisdiction at the Project Site.

B. Source Quality Control: Provide all metal sheet, wire, plate, and bar stock masonry accessories from the same manufacturer.

C. Sample Panel: The Contractor shall erect sample panel.

1. The sample panel shall include facing veneer, bond pattern, mortar color, tooled joints, control joints, insulation, reinforcing, all masonry accessories and backup.

2. Upon approval, the sample panel shall remain in place for the duration of masonry construction and shall be used as a basis of comparison for all masonry Work.

3. After final approval of finished masonry Work by the Engineer, the Contractor shall demolish the sample panel, and shall perform all Site restoration Work.

4. Sample Panels: Prior to installation of unit masonry Work, but after Engineer's approval of samples, erect job mock-ups using materials, pattern bond and joint tooling shown or specified for final Work. Build mock-ups at the Site, in location approved by the Engineer. Indicate the proposed range of color, texture, and workmanship to be expected in the completed Work in each area of the Work. Obtain Engineer's acceptance of visual qualities of the mock-ups before start of masonry Work. Retain and protect mock-ups during construction as a standard for judging completed masonry Work. Do not alter, move, or destroy mock-ups until given written permission by Engineer. Masonry construction that does not meet the standards approved on the job mock-ups shall be removed and rebuilt as required by Engineer. Provide mock-ups of the portions of the unit masonry partition intersection showing all special shapes to be used in the Work.

1.04 SUBMITTALS

A. The Contractor shall prepare and submit for approval catalog cuts, drawings, and reference materials in accordance with Section 01 33 00 – Submittal Procedures. Submittals shall include the following:

1. Samples: The Contractor shall submit three (3) samples each of filled ground face concrete masonry units and decorative concrete masonry units that are representative of the full range of color, shading and texture of the material to be provided.

2. Test Reports: The Contractor shall submit material test reports or manufacturer's certificate of compliance for filled ground face concrete masonry units, concrete masonry units, and decorative concrete masonry units.

B. Working Drawings: Submit for approval the following:

1. Copies of manufacturer’s specifications and installation instructions for each masonry accessory required. Include data substantiating that materials comply with specified requirements.

2. Provide drawings and material schedules showing all dimensions and sizes of masonry accessories coordinated with unit masonry construction Work, and other Work in which masonry accessories will be embedded, be supported from, or restrain.

3. Indicate methods for identifying and coordinating, at the Site, the location and accurate placement of each masonry accessory in unit masonry construction as the Work progresses. Indicate by letter of transmittal that items which must be installed in the shop have been received in time for proper sequencing of the Work to avoid delays.

4. Complete layout of all unit masonry walls showing modular planning and all special shapes to be used in the Work. Show all details for each condition encountered in the Work. Provide plan and elevation views drawn at one-quarter (1/4)-inch scale and details drawn at one and one-half (1 1/2)-inch scale. Show all items required to be built into unit masonry construction.

5. Masonry control joint locations and details.

6. Drawings showing the location, extent, and accurate configuration and profile of all items shown, specified, and required by this and other Sections to be built into the unit masonry construction as the Work progresses. Provide

elevations drawn at one-quarter (1/4)-inch scale and all details drawn at one and one-half (1-1/2)-inch scale.

7. Drawings for fabrication, bending, and placement of reinforcing bars. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcing for unit masonry construction.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: All products and materials shall be delivered, stored, and handled as follows.

B. Delivery and Storage: Prefaced Concrete Unit Masonry materials delivered and stored at the Site shall be from approved manufacturers and sources only.

C. Masonry Units:

1. Masonry units shall be handled in a manner which prevents undue breakage or chipping.

2. Prefaced Concrete Unit Masonry shall be unloaded using brick clamps.

3. All masonry units shall be stored on platforms under shelter or in another approved manner so as to protect these materials from soil and weather.

D. Rejection: Prefaced Concrete Unit Masonry that are warped, cracked or of inferior quality will be rejected. Such items shall be removed from the Site and not offered again for inspection.

E. Manufactured materials, shall be delivered and stored in their original containers, plainly marked with identification of material and maker. Materials in broken containers, or in packages showing water marks or other evidence of damage, shall not be used and shall be removed from Site.

1.06 DESIGN REQUIREMENTS

A. Provide masonry accessories of sizes, dimensions, and configurations coordinated with unit masonry construction system component sizes, dimensions, and configurations.

B. Where continuous horizontal cavity wall reinforcement is specified as providing restraint for cavity wall insulation, coordinate dimensions with thickness of cavity wall insulation specified for proper clearances.

C. Where structural steel will be provided with fireproofing do not use welded-on channel slots. Coordinate required offset of welded-on wire ties with depth of fireproofing.

D. Concrete Masonry Units: Limit total moisture absorption until time of installation to the maximum percentage specified for Type I units for the average annual relative humidity as reported by the United States Weather Bureau Station nearest the Site and the corresponding percentage of total linear drying shrinkage of the concrete masonry units.

E. Comply with ASTM C90 Climatic Map establishing criteria for percent annual mean relative humidity.

F. Structural elements of masonry shall conform to the requirements of ACI 530/ASCE 5/TMS 402 for materials and installation.

G. Masonry materials and installation shall conform to the requirements of ACI 530.1/ASCE 6/TMS 602.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Ground Face Concrete Masonry Units (GFB) as manufactured by the following:

1. Verastone Plus masonry units by Trenwyth Industries, Incorporated., One Connelly Road, Emigsville, PA 17318, Phone: 717-767-6868, Web: www.trenwyth.com

2. Pozzotive Ground Faced with Crystal Coat Plus masonry units by Kingston Block & Masonry Supply Company, 1 Kieffer Lane, Kingston, NY 12401, Phone 845 338-9900, Web: www.kingstonblock.com

3. Or approved equal.

B. Concrete Masonry Units as manufactured by the following:

1. Trenwyth Industries, Incorporated., One Connelly Road, Emigsville, PA 17318, Phone: 717-767-6868, Web: www.trenwyth.com

2. Pozzotive Masonry Units by Kingston Block & Masonry Supply Company, 1 Kieffer Lane, Kingston, NY 12401, Web: www.kingstonblock.com.

3. Or approved equal.

C. Integral Block Water Resistive Additive shall be provided by the following:

1. Crystal Coat Plus as manufactured by Acme-Hardesty Co., 1787 Sentry Parkway West, Suite 18-460, Blue Bell, PA 19422, Web: www.acme-hardesty.com

2. Grace Construction Products DRY-BLOCK as distributed by Trenwyth Industries

3. One Connelly Road, Emigsville, PA 17318, Web: www.trenwyth.com

4. Or approved equal.

2.02 MATERIALS / EQUIPMENT

A. Concrete Masonry Units: Concrete masonry units shall be manufactured with lightweight aggregate and shall be provided as follows:

1. Hollow Load-Bearing Units: Hollow load-bearing units shall conform to ASTM C90, Type I for exterior walls, foundation walls, interior load-bearing and nonload-bearing walls and partitions. Units shall have a compressive strength of three thousand (3,000) psi over the net area.

2. Solid Load-Bearing Units: Solid load-bearing units shall conform to ASTM C90, Type I, except units exposed to weather shall be Grade U. Solid units shall be provided for masonry bearing under structural framing members and for fireproofing of steel structural members. Units shall have a compressive strength of three thousand (3,000) psi over the net area.

3. Special Shapes: Special shapes, such as closures, header units, and jamb units shall be provided as necessary to complete the Work. Special shape units shall conform to the applicable provisions for the units with which they are used.

4. Recycle Content: Replacement of cement portion of Concrete Masonry Units of a minimum of either twenty percent (20%) post-consumer content or thirty-eight percent (38%) pre-consumer recycled content.

5. Face Size: Seven and five-eighths (7-5/8)-inch by fifteen and five-eighths (15-5/8)-inch. Unless notes otherwise.

B. Ground Faced Concrete Masonry Veneer Units (GFB): Provide pre-finished integrally colored units with one or more faces ground to expose the variegated colors of the natural aggregates with water resistive additive with a minimum cured strength and durability equal to the concrete masonry units. The ground faced surface shall have a factory applied heat treated acrylic coating and

field coated with UV cured acrylic or water-based coating system in accordance with manufacturer’s specifications. Provide the following:

1. Manufacturer's units complete selection of all standard and custom colors for final selection by the Engineer.

2. Recycle Content: Replacement of cement portion of Ground Faced Masonry Units of a minimum of either twenty percent (20%) post-consumer content or thirty-eight percent (38%) pre-consumer recycled content.

3. Color, surface texture, and aggregate uniform within the normal range established by sample submission and as approved by the Engineer.

4. Provide white sand mortar for white units and mortar color matching the units selected. Mortar color match to units are provided by the manufacturer of Filled Ground Faced Concrete Masonry Units.

5. The Engineer will select a maximum of eight (8) colors for the Work.

6. Face Size: Seven and five-eighths (7-5/8)-inch by fifteen and five-eighths (15-5/8)-inch.

7. Integral Water Resistive Additive: Shall comply with the following ASTM standards:

    a. ASTM E-514 – display no penetration of water during seventy-two (72)-hours of testing. Rating class E no dampness reported.

    b. ASTM C140 – shall exceed strength standards in all cases when compared with control blocks.

    c. ASTM C67 – shall have one-quarter (1/4) the initial Rate of Absorption when compared with control blocks.

    d. ASTM 1070 – Lab tests shall indicate no difference between bond strength of blocks when compared with control blocks.

    e. ASTM C780 – mortar cures average twelve percent (12%) greater compressive strength.

    f. ASTM E90-86 – pass (Display of “breathability or compatibility to bar water entry while allowing moisture vapor to escape”).

C. Masonry Anchorage and Reinforcing: Masonry Anchorage and Reinforcing materials shall be in accordance with Section 04 05 19 – Masonry Anchorage and Reinforcing.

D. Mortar Materials: Mortar materials shall be in accordance with Section 04 05 13 – Masonry Mortaring.

E. Grout Materials: Grout materials shall be in accordance with Section 04 05 16 – Masonry Grouting.

PART 3 – EXECUTION

3.01 EXAMINATION / PREPARATION

A. It is required that personal protective equipment be used for all masonry Work in accordance with OSHA requirements. Do not mix more material than can be used within thirty (30) minutes. Discard any mixed material that has been unused for thirty (30) minutes or more.

B. Leave openings for equipment, piping, ducts, and other items to be installed subsequent to starting of unit masonry construction. After installation of said items, complete unit masonry construction to match Work immediately adjacent to openings.

C. Use full size units without cutting wherever possible. Provide special unit masonry shapes for all transitions and intersections. Do not field-cut special shapes from regular unit masonry shapes or substitute other alternatives for the use of special unit masonry shapes.

D. Build interior masonry walls, visible from both sides in the finished Work, using two wythes of masonry. Filled ground face masonry units shall be continuous over the entire plan of the wall including walls which continue behind fixtures, equipment, furniture, lockers, and similar items.

E. Environmental Conditions: Refer to Section 04 05 13 – Masonry Mortaring, Article 3.02.C, for Environmental Condition requirements for masonry Work.

F. Environmental Conditions:

1. Site Facilities: Supplemental heat sources, as may be required should the Contractor wish to continue unit masonry construction in cold weather, are not available at the Site. The provision and expense of all supplemental heat energy sources, fuel, and equipment is the responsibility of the Contractor.

3.02 APPLICATION

A. Unit Condition: Concrete masonry units shall be placed dry with no previous wetting.

B. Build interior masonry walls, visible from both sides in the finished Work, using two (2) wythes of masonry. Filled ground face masonry units shall be continuous over the entire plan of the wall including walls which continue behind fixtures, equipment, furniture, lockers, and similar items.

C. Coursing: Masonry walls shall be carried up level and plumb all around. Do not carry up one section of the walls in advance of the others, unless specifically approved. Heights of masonry shall be checked with an instrument at each floor, and at sills and heads of openings, to maintain the level of walls. Masonry courses shall be maintained to a uniform dimension. Vertical and horizontal joints shall be formed to a uniform thickness. Concrete masonry units shall be laid in running bond. One (1) unit and one (1) mortar joint shall be coursed to equal eight (8) inches. Mortar joints shall be tooled to be concave.

D. Placing and Bonding: Masonry units shall be placed in a full bed of mortar, with full head joints, and shall be uniformly jointed with other Work.

E. Bond: Concrete masonry units shall be laid in a running bond pattern with vertical joints aligned with joints in alternative courses above and below.

1. Mortar Removal: Excess mortar shall be removed as the installation progresses.

2. Corners and Intersections: Intersections and external corners shall be interlocked. Horizontal reinforcing shall be spliced at intersections and corners with a six (6)-inch overlap of side rods.

3. Adjustment: Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, mortar shall be removed and replaced with new mortar.

4. Cutting: Job Site cutting of exposed masonry units shall be performed with power masonry saws to provide straight, clean, unchipped edges. Broken masonry unit corners or edges shall not be allowed.

5. Flush Joints: Mortar joints shall be cut flush where ceramic wall tile is to be installed.

6. Control Joints: Nonload-bearing masonry partitions shall be isolated from vertical and horizontal structural framing members with control joints.

7. Placing Metalwork: Structural steelwork, bolts, anchors, inserts, plugs, ties, lintels, and miscellaneous metalwork specified in other Sections, shall be placed and built into position as the installation progresses.

8. Extent of Masonry: Masonry partitions and walls shall extend from the floor to the bottom of floor or roof construction above, unless otherwise indicated.

9. Bonding and Anchoring: Walls and partitions shall be structurally bonded or anchored to each other and to concrete walls, beams, columns, and wall and roof diaphragms. Nonload-bearing walls and partitions shall be anchored to construction above in a manner that provides appropriate lateral stability and vertical movement of floor and roof construction above.

10. Preparation for New Work: Unfinished masonry shall be stepped back for joining with new masonry. Toothing will not be permitted.

11. Filled ground face concrete masonry units shall be laid in a running bond pattern. All vertical exterior corners are to be bullnose shape.

12. Units shall be hand selected from the stock of more than one (1) pallet at a time in order to help insure uniform distribution of possible color differences in material.

13. Mortar joints in filled ground face concrete masonry units shall be raked back minimum of one-quarter (1/4) inch, allowed to cure for twenty-four (24) hours, and then shall be pointed using pointing mortar with waterproofing additive as specified in Section 04 05 13 – Masonry Mortaring.

14. Bed and Head Joints: The first course of concrete masonry units shall be laid in a full bed of mortar for the full width of the unit. Bed joints of concrete masonry units shall be formed by applying the mortar to the entire top surfaces of the inner and outer face shells, and head joints shall be formed by applying the mortar for a width of about one (1) inch to the ends of the adjoining units laid previously. Joints shall be mortared smooth, not furrowed, and of such thickness that mortar will be forced out of the joints as the units are being placed in position. Where anchors, bolts, reinforcing and ties occur within the cells of the units, such cells shall be filled solid with grout as the Work progresses.

F. Horizontal Joint Reinforcement and Anchorages: shall be in accordance with Section 04 05 19 – Masonry Anchorage and Reinforcing.

G. Control Joints: Preformed control joint material shall be installed in continuous lengths. Butt and corner joints shall be sealed in accordance with manufacturer’s instructions. Control joints shall be sized as indicated on the Contract Drawings. Horizontal joint reinforcement shall not continue through control joints.

H. Built-In Work: Metal door and window frames, fabricated metal frames, louvered openings, anchor bolts, pipes, ducts, conduits, plates, and items specified in other

sections shall be built in as the Work progresses. Items shall be built in plumb and level. Frame voids shall be filled solid with grout. Adjacent masonry cores shall be filled with grout for a minimum of twelve (12) inches beyond the framed openings. Do not build in organic materials subject to deterioration.

I. Tolerances: Masonry Work shall meet the tolerances specified in ACI 530.1/ASCE 6-95/TMS 602.

1. Variation from Plumb: For lines and surfaces of columns, walls, and rises, do not exceed one-quarter (1/4) inch in ten (10) feet, or three-eighths (3/8) inch in a story height or twenty (20) feet maximum, nor one-half (1/2) inch in forty (40) feet or more. Except for external corners, expansion joints and other conspicuous lines, do not exceed one-quarter (1/4) inch in any story or twenty (20) feet maximum, nor one-half (1/2) inch in forty (40) feet or more.

2. Variation from Level: For lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed one-quarter (1/4) inch in any bay or twenty (20) feet maximum, nor three-quarters (3/4) inch in forty (40) feet or more.

3. Variation of Linear Building Line: For position shown in Contract Drawings and related portion of columns, walls and partitions, do not exceed one-half (1/2) inch in any bay or twenty (20) feet maximum, nor three-quarters (3/4) inch in forty (40) feet or more.

4. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed plus or minus one-quarter (1/4) inch.

J. Cutting and Fitting: Masonry shall be cut and fit for chases, pipes, conduit, sleeves, grounds, and other items specified elsewhere. The Work shall be coordinated to provide correct size, shape, and location.

K. Waterproofing Course: A waterproofing course of flashing as specified in Section 07 60 00 – Sheet Metal Flashing and Trim shall be provided where shown, and at the following locations: at the bottom of masonry walls, at water tables, at points where roofs adjoin exterior masonry walls, at lintels, below louver sills and window sills, under architectural masonry coping and at other locations shown on the Contract Drawings.

L. Laying Masonry Walls, General: Lay out walls in advance for accurate spacing of surface pattern bond with uniform joint widths and to properly locate openings, masonry control joints, returns and offsets. Avoid the use of less than half size units at corners, jambs and wherever possible at other locations.

1. Lay up walls plumb and true to comply with specified tolerances, with courses level, accurately spaced and coordinated with other Work.

2. Provide minimum bearing at each jamb, of four (4) inches for openings less than six (6) feet zero (0) inches wide, and eight (8) inches for wider openings.

3. On concrete and clay unit masonry walls where pattern bond remains visually exposed, increase minimum bearing of masonry lintels to maintain continuity of joint pattern of wall and install so as to be indistinguishable from surrounding masonry.

M. Collar Joints:

1. Fill the vertical space between wythes solidly with mortar by parging the in place wythe and shoving units into the parging, for the locations by not limited to the following:

2. All exterior and interior and or multi wythe (except do not fill cavity of cavity wall construction), walls and partitions.

N. Mortar Color and Texture:

1. Lay all concrete unit masonry using mortar of natural color.

2. Lay all glazed structural tile and filled ground face concrete unit masonry Work using mortar of natural color. Rake as specified to receive pointing mortar.

O. Hand select ground face masonry units to assure uniform continuity of finished surfaces from unit to unit. Glazed structural tile with misaligned face ceramic glazing shall be permanently removed from the Site.

P. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point up all joints at corners, openings, and adjacent Work to provide a neat, uniform appearance, properly prepared for application of sealant compounds.

Q. Masonry Mortaring shall be in accordance with Section 04 05 13 – Masonry Mortaring.

R. Grouting shall be in accordance with Section 04 05 16 – Masonry Grouting.

3.03 FIELD TESTING / QUALITY CONTROL

A. Sample Panel: Masonry Work shall not be started until the specified Sample Panel has been approved. The Sample Panel shall be used as a standard for comparison

of masonry Work. Sample Panel shall be destroyed only after all masonry Work has been completed and approved by the Engineer.

B. Remove and replace masonry units that are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

3.04 ADJUSTING / PROTECTION / CLEANUP

A. General: After mortar has set, new masonry Work shall be cleaned as follows:

1. All masonry: All excess mortar and mortar smears shall be removed. Any defective mortar shall be removed and replaced, matching adjacent Work. Nonmetallic tools shall be used in all cleaning operations.

2. Concrete Masonry, Filled Ground Faced Concrete Masonry, and Ground Faced: Areas to be cleaned shall be soaked with water, then scrubbed, followed by a rinse with clean water. Fiber brushes shall be used to apply the cleaning solution and to wash the blockwork. Do not allow the acid solution to come in contact with metalwork, blockwork and stonework below the area being cleaned shall be kept wet during the cleaning process. Cleaning product shall be Light Duty Concrete Cleaner (dilution one [1] to three [3] parts clean water) as manufactured by Prosoco or approved equal.

B. Protection: At all times, surfaces of masonry on which Work is not being performed shall be protected. When rain or snow is imminent, and Work is discontinued, tops of exposed masonry walls and similar surfaces shall be covered with a strong waterproof membrane, well secured in place.

C. Protection of Finished Work: Protective boards shall be provided at exposed external corners susceptible to damage by construction activities, without damaging completed Work.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 05 05 13

GALVANIZING

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Where galvanizing is called for in the Contract Documents, the galvanizing shall be performed in accordance with the provisions of this Section unless otherwise noted.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Further requirements for galvanizing specific items may be included in other Sections of the Specifications. See other Sections for the specific item in question.

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. New York State Building Code

2. ASTM A123 – Standard Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip

3. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

4. ASTM A653 – Standard Specification for Steel Sheet, Zinc Coated (Galvanized), or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

5. ASTM A924 – Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

6. ASTM A780 – Standard Practice of Repair of Damaged Hot-Dip Galvanized Coatings

7. ASTM F2329 – Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

1.04 SUBMITTALS

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A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures.

1. Certification that the item(s) are galvanized in accordance with the applicable ASTM standards specified herein. This certification may be included as part of any material certification that may be required by other Sections of the Specifications.

PART 2 – PRODUCTS

2.01 GALVANIC COATING

A. Material composition of the galvanic coating shall be in accordance with the applicable ASTM standards specified herein.

PART 3 – EXECUTION

3.01 FABRICATED PRODUCTS

A. Products fabricated from rolled, pressed, and forged steel shapes, plates, bars, and strips, 1/8 inch thick and heavier which are to be galvanized shall be galvanized in accordance with ASTM A123. Products shall be fabricated into the largest unit which is practicable to galvanize before the galvanizing is done. Fabrication shall include all operations necessary to complete the unit such as shearing, cutting, punching, forming, drilling, milling, bending, and welding. Components of bolted or riveted assemblies shall be galvanized separately before assembly. When it is necessary to straighten any sections after galvanizing, such work shall be performed without damage to the zinc coating. The galvanizer shall be a member of American Galvanizers Association.

B. Components with partial surface finishes shall be commercial blast cleaned prior to pickling.

C. Sampling and testing of each lot shall be performed prior to shipment from the galvanizer’s facility per ASTM A123.

3.02 HARDWARE

A. Iron and steel hardware which is to be galvanized shall be galvanized in accordance with ASTM A153 and ASTM F2329.

3.03 ASSEMBLED PRODUCTS

A. Assembled steel products which are to be galvanized shall be galvanized in accordance with ASTM A123. All edges of tightly contacting surfaces shall be completely sealed by welding before galvanizing.

B. Assemblies shall be provided with vent and drain holes as required by the fabricator. Vent and drain hole sizes and locations shall be included in the structural steel shop drawings required in Section 05 12 00 – Structural Steel for approval. All vent and drain

holes shall be plugged and finished to be flush with and blend in with the surrounding surface. Where water intrusion can occur, the plug shall be carefully melted into the surrounding zinc coating using an appropriate fluxing agent.

3.04 METAL DECK

A. Unless noted otherwise, metal deck shall be galvanized in accordance with ASTM A653 G60 minimum. In moist environments or as indicated on the Contract Drawings, galvanizing shall meet the requirements of ASTM A653 G90.

B. Galvanized metal deck shall meet the requirements of ASTM A924.

3.05 REPAIR OF GALVANIZING

A. Galvanized surfaces that are abraded or damaged at any time after the application of zinc coating shall be repaired by thoroughly wire brushing the damaged areas and removing all loose and cracked coating, after which the cleaned areas shall be painted with 2 coats of zinc rich paint meeting the requirements of Federal Specification DOD-P-21035A and shall be thoroughly mixed prior to application. Zinc rich paint shall not be tinted. The total thickness of the 2 coats shall not be less than 6 mils. In lieu of repairing by painting with zinc rich paint, other methods of repairing galvanized surfaces in accordance with ASTM A780 may be used provided the proposed method is acceptable to the Engineer.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 05 05 23
METAL FASTENING

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Furnish all materials, labor, and equipment required to provide all metal welds and fasteners not otherwise specified, in accordance with the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 05 05 13 – Galvanizing

B. Section 05 10 00 – Metal Materials

C. Section 05 12 00 – Structural Steel

D. Section 05 13 00 – Stainless Steel

E. Section 05 14 00 – Structural Aluminum

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. New York State Building Code
2. AC 193 – Acceptance Criteria for Mechanical Anchors in Concrete Elements
3. AC 308 – Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements
4. ACI 318 – Building Code Requirements for Structural Concrete
5. ACI 355.2 – Qualifications of Post-Installed Mechanical Anchors in Concrete
6. ACI 355.4 – Qualifications of Post-Installed Adhesive Anchors in Concrete
7. AISC – RCSC Specification for Structural Joints Using High Strength Bolts
8. AISC – Code of Standard Practice
9. AWS D1.1 – Structural Welding Code – Steel
10. AWS D1.2 – Structural Welding Code – Aluminum

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11. AWS D1.6 – Structural Welding Code – Stainless Steel

12. Aluminum Association – Specifications for Aluminum Structures

13. ASTM A572/A572M-94C – Standard Specification for High Strength Low-Alloy Columbium-Vanadium Structural Steel Grade 50

14. ASTM A36 – Standard Specification for Carbon Structural Steel

15. ASTM A489 – Standard Specification for Eyebolts

16. ASTM A563 – Standard Specifications for Carbon and Alloy Steel Nuts

17. ASTM D1785 – Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe

18. ASTM E3121 – Standard Test Methods for Field Testing of Anchors in Concrete or Masonry

19. ASTM F436 – Standard Specification for Hardened Steel Washers

20. ASTM F467 – Standard Specification for Nonferrous Nuts for General Use

21. ASTM F593 – Standard Specification for Stainless Steel Bolts; Hex Cap Screws, and Studs

22. ASTM F594 – Standard Specification for Stainless Steel Nuts

23. ASTM F1554 – Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

24. ASTM F3125 – Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength, Inch and Metric Dimension

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures.

1. Shop Drawings providing the fastener's manufacturer and type and certification of the fastener's material and capacity.

2. Anchor design calculations sealed by a Professional Engineer currently registered in New York State. Only required if design not shown on Contract Drawings.

3. A current Evaluation Report shall be submitted for all anchors that will be considered for use on this project.

4. Manufacturer’s installation instructions.

5. Copy of valid certification for each person who is to perform field welding.

6. Certified weld inspection reports, when required.

7. Welding procedures.

8. Installer qualifications.

9. Certification of Installer Training.

10. Inspection Reports.

11. Results of Anchor Proof Testing.

12. Manufacturer's Literature for Resistance of Adhesive to Appropriate Chemical Exposure, where deemed necessary.

1.05 QUALITY ASSURANCE

A. Fasteners not manufactured in the United States shall be tested and certification provided with respect to specified quality and strength standards. Certifications of origin shall be submitted for all U.S. fasteners supplied on the project.

B. Evaluation Report: A current Evaluation Report from an independent testing and evaluation agency (ITEA) shall be submitted for all anchors that will be used on this project. The ITEA producing the evaluation report shall be accredited in accordance with the requirements for ITEA's in ACI 355.2 (for mechanical anchors) or 355.4 (for adhesive anchors). Acceptable ITEA's include but are not necessarily limited to the International Code Council Evaluation Service (ICC-ES) and the International Association of Plumbing and Mechanical Officials Uniform Evaluation Service (IAPMO-UES).

C. Installer Qualifications: All concrete anchors shall be installed by an Installer with at least three years of experience performing similar installations. Concrete adhesive anchor installers for anchor installations in horizontal to vertically overhead applications shall be certified as an Adhesive Anchor Installer in accordance with ACI-CRSI Adhesive Anchor Installation Certification Program.

D. Installer Training: For concrete anchors, conduct a thorough training with the manufacturer or the manufacturer's representative for the Installer on the project. Training shall consist of a review of the complete installation process to include but not be limited to the following:

1. Hole drilling procedure.

2. Hole preparation and cleaning technique.

3. Adhesive injection technique and dispenser training/maintenance.

4. Concrete adhesive anchor preparation and installation.

5. Proof loading/torquing.

6. Provide a list of names of all installers who are trained by the Manufacturer's Field Representative on this jobsite prior to installation of products. Record must include the installer name, date of training, products included in the training and trainer name and contact information.

7. Provide a copy of the current ACI/CRSI "Adhesive Anchor Installer" certification cards for all installers who will be installing adhesive anchors in the horizontal to vertically overhead orientation.

E. All steel welding shall be performed by welders certified in accordance with AWS D1.1. All aluminum welding shall be performed by welders certified in accordance with AWS D1.2. All stainless-steel welding shall be performed by welders certified in accordance with AWS D1.6. Certifications of field welders shall be submitted prior to performing any field welds.

F. Welds and high strength bolts used in connections of structural steel will be visually inspected in accordance with Article 3.04 of this Section.

G. The Owner may engage an independent testing agency to perform testing of welded connections and to prepare test reports in accordance with AWS. Inadequate welds shall be corrected or redone and retested to the satisfaction of the Engineer and/or an acceptable independent testing laboratory, at no additional cost to the Owner.

H. Provide a welding procedure for each type and thickness of weld. For welds that are not prequalified, include a Performance Qualification Report. The welding procedure shall be given to each welder performing the weld. The welding procedure shall follow the format in Annex E of AWS D1.1 with relevant information presented.

I. Special inspections for concrete adhesive anchors shall be conducted in accordance with the manufacturer's instructions and Section 01 45 33 – Special Inspections. Downward installations require periodic inspection and horizontal and overhead installations require continuous inspection.

PART 2 – PRODUCTS

2.01 ANCHOR RODS

A. Anchor rods shall conform to ASTM F1554 Grade 55 except where stainless steel or other approved anchor rods are shown on the Drawings or stated herein. Anchor rods shall have hexagonal heads and shall be supplied with hexagonal nuts meeting the requirements of ASTM A563 Grade A. Washers shall meet the requirements of ASTM A436.

B. All anchors into concrete shall be cast-in-place anchors unless specifically referenced otherwise on Drawings.

C. Where anchor rods are used to anchor galvanized steel or are otherwise specified to be galvanized, anchor rods and nuts shall be hot dipped galvanized in accordance with ASTM F1554.

D. Where pipe sleeves around anchor rods are shown on the Drawings, pipe sleeves shall be cut from Schedule 40 PVC plastic piping meeting the requirements of ASTM D1785.

2.02 HIGH STRENGTH BOLTS

A. High strength bolts and associated nuts and washers shall be in accordance with ASTM F3125, Grade A325 Type 1 or Grade F1852 Type 1. Bolts, nuts, and washers shall meet the requirements of RCSC “Specification for Structural Joints Using High Strength Bolts”.

B. Where high strength bolts are used to connect galvanized steel or are otherwise specified to be galvanized, bolts, nuts, and washers shall be hot dipped galvanized in accordance with ASTM A325.

2.03 STAINLESS STEEL BOLTS

A. Stainless steel bolts shall conform to ASTM F-593 for alloy groups 1 and 2, Condition CW1, or ASTM F-3125. All underwater fasteners, fasteners in confined areas containing fluid, and fasteners in corrosive environments shall be Type 316 stainless steel unless noted otherwise. Fasteners for aluminum and stainless-steel members not subject to the above conditions shall be Type 304 stainless steel unless otherwise noted.

B. Stainless steel bolts shall have hexagonal heads with a raised letter or symbol on the bolts indicating the manufacturer and shall be supplied with hexagonal nuts meeting the requirements of ASTM F594. Nuts, washers, and lock washers shall be of the same alloy as the bolts.

2.04 CONCRETE ANCHORS

A. General

1. Where concrete anchors are called for on the Drawings, one of the types listed below shall be used; except, where one of the types listed below is specifically called for on the Drawings, only that type shall be used. If no specific type is indicated on the Drawings, the concrete anchor shall be a cast-in-place anchor. The determination of anchors equivalent to those listed below shall be based on test data performed by an approved independent testing laboratory. Two types of anchors shall be used:

    a. Mechanical anchors include any of the following anchors:

1) Expansion anchors shall be mechanical anchors of the wedge, sleeve, or drop-in type that are set by expanding against the sides of the drilled hole.

2) Screw anchors are mechanical anchors that derive tensile holding strength by the mechanical interlock provided by threads cutting into the concrete during installation. Screw anchors shall be one-piece, heavy duty screw anchors with a finished head.

b. Adhesive anchors shall consist of threaded rods or bolts anchored with an adhesive system into hardened concrete. Adhesive anchors shall be two-part injection type using the manufacturer's static mixing nozzle and shall be supplied as an entire system.

2. Adhesive anchors shall conform to the requirements of ACI 355.4 or alternately to AC 308. Mechanical anchors shall conform to the requirements of ACI 355.2 or alternately to AC 193. Anchors in Seismic Design Categories C through F shall conform to the International Building Code and ACI 318 Appendix D requirements as applicable, including seismic test requirements.

3. Fire Resistance: All anchors installed within fire resistant construction shall either be enclosed in a fire-resistant envelope, be protected by approved fire-resistive materials, be used to resist wind and earthquake loads only, or anchor non-structural elements.

4. Engineer's approval is required for use of concrete anchors in locations other than those shown on the Drawings.

B. Wedge Anchors:

1. Do not use when subjected to vibration.

2. Do not use in exterior locations or locations subjected to freezing.

3. Do not use in submerged, intermittently submerged, or buried locations.

4. Suitable for use in overhead applications.

C. Screw Anchors:

1. Do not use when subjected to vibration.

2. Do not use in exterior locations or locations subjected to freezing.

3. Do not use in submerged, intermittently submerged, or buried locations.

4. Do not use in overhead applications.

D. Sleeve Anchors:

1. Do not use when subjected to vibration.
2. Do not use in exterior locations or locations subjected to freezing.
3. Do not use in submerged, intermittently submerged, or buried locations.
4. Suitable for use in overhead applications.

E. Undercut Anchors:

1. Suitable for use where subjected to vibration.
2. Do not use in exterior locations or locations subjected to freezing.
3. Do not use in submerged, intermittently submerged, or buried locations.
4. Suitable for use in overhead applications.

F. Adhesive Anchors in Concrete:

1. Suitable for use where subjected to vibration.
2. Suitable for use in exterior locations or locations subjected to freezing.
3. Suitable for use in submerged, intermittently submerged, or buried locations.
4. Do not use in overhead applications, unless otherwise shown or approved by Engineer.
5. Suitable for use in chemical areas provided manufacturer’s literature confirms appropriate chemical resistance.
6. Do not use for pipe hangers, unless otherwise shown or approved by Engineer.

G. Adhesive Anchors in Masonry

1. Suitable for use where subjected to vibration.
2. Suitable for use in exterior locations or locations subjected to freezing.
3. Do not use for pipe hangers, unless otherwise shown or approved by Engineer.
4. Suitable for use in precast hollow core planks.

H. Concrete Anchor Design:

1. Basis of design shall include the following design parameters:

a. Actual compressive strength of concrete.

b. Cracked concrete conditions.

c. Dry or water saturated installation conditions.

d. Base material temperature between 40- and 104-degrees Fahrenheit.

e. Installation with hammer drill or hollow-drill bit system drilling methods.

f. Installation not prior to 21-day minimum age of concrete.

2. An anchor design consists of specifying anchor size, quantity, spacing, edge distance and embedment to resist all applicable loads. Where an anchor design is indicated on the Drawings, the anchors shall be installed to the prescribed size, spacing, embedment depth, and edge distance. If all parts of an anchor design are provided on the Drawings except embedment depth, the Contractor shall provide the embedment depth as indicated in Paragraph B.3 of this Article unless otherwise directed by the Engineer. Where an anchor design is not indicated on the Drawings, the Contractor shall provide the anchor design per the requirements listed below.

   a. The Contractor shall submit design with signed and sealed calculations and drawings performed by an Engineer currently registered in New York State. Anchors shall be of a type recommended by the anchor manufacturer for use in cracked concrete and shall be designed by the Contractor in accordance with ACI 318 Appendix D.

   b. Embedment Depth

      1) Minimum anchor embedment shall be as indicated on the Drawings unless anchor design is stipulated to be by Contractor or equipment provider. The provider of equipment including pumps, blowers, etc. shall provide anchor design including size of anchors, pattern, and embedment depth. If the equipment provider is unable to provide design of embedment depth, the design shall be provided by the contractor using the loads furnished by the equipment provider. Although all manufacturers listed are permitted, the embedment depth indicated on the Drawings is based on “Hilti HY-200 by Hilti, Inc.” If the contractor submits one of the other concrete adhesive anchors listed, the Engineer shall evaluate the required embedment and the Contractor shall provide the required embedment depth stipulated by the Engineer specific to the approved dowel adhesive.

      2) Where the embedment depth is not shown on the Drawings, concrete anchors shall be embedded no less than the manufacturer’s standard embedment (expansion or mechanical anchors) or to provide a

minimum allowable bond strength equal to the allowable yield capacity of the rod according to the manufacturer (adhesive anchors).

3) The embedment depth shall be determined using the actual concrete compressive strength, a cracked concrete state, maximum long-term temperature of 110 degrees F, and maximum short-term temperature of 140 degrees F. In no case shall the embedment depth be less than the minimum or more than the maximum stated in the manufacturer's literature.

I. Anchors:

1. Mechanical Anchors:

a. Wedge Anchors: Wedge anchors shall be:

1) "Kwik Bolt TZ" by Hilti, Inc.;

2) "Strong-Bolt 2" by Simpson Strong-Tie Co.;

3) "Power-Stud+SD1" or "Power-Stud+ SD-2" by DeWalt;

4) Or approved equal.

b. Screw Anchors: Screw anchors shall be:

1) "KWIK HUS-EZ", "KWIK HUS-EZ-I", or "KWIK HUS-EZ CRC" by Hilti, Inc.;

2) "Titen HD" or "Stainless Steel Titen HD" by Simpson Strong-Tie Co.;

3) "Screw-Bolt+" by DeWalt;

4) Or approved equal.

c. Sleeve Anchors: Sleeve anchors shall be:

1) "HSL-3 Heavy Duty Sleeve Anchor" by Hilti, Inc;

2) "Power-Bolt +" by DeWalt;

3) Or approved equal.

d. Shallow Embedment Internally Threaded Insert (3/4" max embedment):

1) "Mini-Undercut +Anchor" by DeWalt;

2) "HDI-P-TZ" by Hilti, Inc.;

3) Or approved equal.

e. Concrete Undercut Anchors: Concrete undercut anchors shall be:

1) “HDA Undercut Anchors” by Hilti, Inc.;

2) “DUC Ductile Undercut Anchor” by USP Structural Connectors;

3) Or approved equal.

f. Mechanical anchor systems shall comply with ACI 355.2 or alternatively the latest revision of AC 193 and shall have a valid evaluation report in accordance with the applicable building code.

2. Adhesive Anchors:

a. Adhesive anchors shall be:

1) “HIT HY-200 Adhesive Anchoring System” by Hilti, Inc.;

2) “SET-3G Epoxy Adhesive Anchors” by Simpson Strong-Tie Co.;

3) “Pure 110+ Epoxy Adhesive Anchor System” by DeWalt;

4) Or approved equal.

b. Adhesive anchor systems shall be IBC compliant and capable of resisting short term wind and seismic loads (Seismic Design Categories A through F) as well as long term and short term sustained static loads in both cracked and uncracked concrete in all Seismic Design Categories. Adhesive anchor systems shall comply with ACI 355.4 or alternatively the latest revision of AC308 and shall have a valid evaluation report in accordance with the applicable building code.

J. Concrete Anchor Materials:

1. Concrete anchors used to anchor structural steel shall be a threaded steel rod per manufacturer’s recommendations for proposed adhesive system but shall not have a yield strength (fy) less than 58 ksi nor an ultimate strength (fu) less than 72.5 ksi, unless noted otherwise. Where steel to be anchored is galvanized, concrete anchors shall also be galvanized unless otherwise indicated on the Drawings.

2. Concrete anchors used to anchor aluminum, FRP, or stainless steel shall be manufactured from stainless steel unless noted otherwise. All underwater fasteners, fasteners in confined areas containing fluid, and fasteners in corrosive environments shall be Type 316 stainless steel unless noted otherwise. Fasteners

for aluminum and stainless-steel members not subject to the above conditions shall be Type 304 stainless steel unless otherwise noted.

3. Nuts, washers, lock washers and other hardware shall be of a material to match the anchors.

2.05 MASONRY ANCHORS

A. Anchors for fastening to solid or grout-filled masonry shall be adhesive anchors consisting of threaded rods or bolts anchored with an adhesive system. The adhesive system shall be:

1. “HIT HY-270 System” by Hilti, Inc.;

2. “AC100+ Acrylic Adhesive” by DeWalt;

3. “SET-XP” by Simpson Strong-Tie Co.;

4. Or approved equal.

B. Anchors for fastening to hollow masonry or brick shall be adhesive anchors consisting of threaded rods or bolts anchored with an adhesive system dispensed into a screen tube inserted into the masonry. The adhesive system shall use a two-component adhesive mix and shall inject into the screen tube with a static mixing nozzle. Thoroughly clean drill holes of all debris and drill dust prior to installation of adhesive and anchor. Contractor shall follow manufacturer’s installation instructions. The adhesive system shall be:

1. “HIT HY-270 System” by Hilti, Inc.;

2. “AC100+ Acrylic Adhesive” by DeWalt;

3. “SET-XP” by Simpson Strong-Tie Co.;

4. Or approved equal.

C. Masonry anchors used to anchor steel shall be a threaded steel rod per manufacturer’s recommendations for proposed adhesive system but shall not have a yield strength (fy) less than 58 ksi nor an ultimate strength (fu) less than 72.5 ksi, unless noted otherwise. Where steel to be anchored is galvanized, masonry anchors shall also be galvanized.

D. Masonry anchors used to anchor aluminum, FRP, or stainless steel shall be manufactured from stainless steel unless noted otherwise. All underwater fasteners, fasteners in confined areas containing fluid, and fasteners in corrosive environments shall be Type 316 stainless steel unless noted otherwise. Fasteners for aluminum and stainless-steel members not subject to the above conditions shall be Type 304 stainless steel unless otherwise noted.

E. Nuts, washers, lock washers and other hardware shall be of a material to match the anchors.

F. Although all manufacturers listed are permitted, the masonry anchor design is based on "SET-XP by Simpson Strong-Tie ER 265 Revised 1-31-2017. If the Contractor submits one of the other concrete adhesive anchors listed, the Engineer shall evaluate the proposed product and the Contractor shall provide the conditions stipulated by the Engineer specific to the approved adhesive anchor.

2.06 WELDS

A. Electrodes for welding structural steel and all ferrous steel shall comply with AWS Code, using E70 series electrodes for shielded metal arc welding (SMAW), or F7 series electrodes for submerged arc welding (SAW).

B. Electrodes for welding aluminum shall comply with the Aluminum Association Specifications and AWS D1.2.

C. Electrodes for welding stainless steel and other metals shall comply with AWS D1.6.

2.07 WELDED STUD CONNECTORS

A. Welded stud connectors shall conform to the requirements of AWS D1.1 Type C.

2.08 EYEBOLTS

A. Eyebolts shall conform to ASTM A489 unless noted otherwise.

2.09 HASTELLOY FASTENERS

A. Hastelloy fasteners and nuts shall be constructed of Hastelloy C-276. Hastelloy fasteners shall be used for fasteners located in chemical areas containing Hydrochloric Acid (Muriatic Acid), Hydrofluosilicic Acid (Fluoride), or Sulfuric Acid.

2.10 TITANIUM FASTENERS

A. Titanium fasteners, washers, and nuts shall conform to ASTM B348, Grade 2. Titanium fasteners shall be used for fasteners located in chemical areas containing Ferric Chloride or Sodium Hypochlorite.

2.11 ANTISEIZE LUBRICANT

A. Antiseize lubricant shall be:

1. C5-A Anti-Seize by Loctite Corporation;

2. Molykote P-37 Anti-Seize Paste by Dow Corning;

3. 3M Anti-Seize by 3M;

4. Or approved equal.

PART 3 – EXECUTION

3.01 MEASUREMENTS

A. The Contractor shall verify all dimensions and review the Drawings and shall report any discrepancies to the Engineer for clarification prior to starting fabrication.

3.02 FASTENER INSTALLATION

A. Anchor Rods, Concrete Anchors, and Masonry Anchors

1. Anchor rods shall be installed in accordance with AISC "Code of Standard Practice" by setting in concrete while it is being placed and positioned by means of a rigidly held template. Overhead adhesive anchors, and base plates or elements they are anchoring, shall be shored as required and securely held in place during anchor setting to prevent movement during anchor installation. Movement of anchors during curing is prohibited.

2. The Contractor shall verify that all concrete and masonry anchors have been installed in accordance with the manufacturer's recommendations and that the capacity of the installed anchor meets or exceeds the specified safe holding capacity.

3. Concrete anchors shall not be used in place of anchor rods without Engineer's approval.

4. All stainless-steel threads shall be coated with anti-seize lubricant.

B. High Strength Bolts

1. All bolted connections for structural steel shall use high strength bolts. High strength bolts shall be installed in accordance with RCSC “Specification for Structural Joints Using High Strength Bolts”. All bolted joints shall be Type N, snug-tight, bearing connections in accordance with AISC Specifications unless noted otherwise on the Drawings.

C. Stainless Steel Bolts

1. Where connections indicate the use of stainless-steel bolts, the bolts shall be installed to the snug tight condition. Connections shall include stainless steel washers under both the bolt head and the nut head. Lock washers shall be utilized for all connections and shall be placed under the nut head.

D. Concrete Anchors

1. Concrete at time of anchor installation shall be a minimum age of 21 days, have a minimum compressive strength of 2500 psi, and ambient temperature at time of installation shall be at least 50 degrees F.

2. Concrete Anchor Testing:

   a. At all locations, at least 10 percent of all concrete anchors installed shall be proof tested to 80% of the yield strength of the anchor rod, with a minimum of one tested anchor per anchor group.

   b. Contractor shall submit a plan and schedule indicating locations of anchors to be proof tested, load test values and proposed anchor testing procedure (including a diagram of the testing equipment proposed for use) to the Engineer for review prior to conducting any testing. Proof testing of anchors shall be in accordance with ASTM E3121 for the static tension test. If additional tests are required, inclusion of these tests shall be as stipulated on Contract Drawings.

   c. Where Contract Documents indicate anchor design to be the Contractor's responsibility, the Contractor shall submit a plan and schedule indicating locations of anchors to be proof tested and load test values, sealed by a Professional Engineer currently registered in New York State. Documentation shall also be submitted indicating the Contractor's proof testing procedures have been reviewed and the proposed procedures are acceptable. Proof testing procedures shall be in accordance with ASTM E3121.

   d. Concrete Anchors shall have no visible indications of displacement or damage during or after the proof test. Concrete cracking in the vicinity of the anchor after loading shall be considered a failure. Anchors exhibiting damage shall be removed and replaced. If more than 5 percent of tested anchors fail, then 100 percent of anchors shall be proof tested.

   e. Proof testing of concrete anchors shall be performed by an independent testing laboratory hired directly by the Contractor and approved by the Engineer. The Contractor shall be responsible for costs of all proof testing, including additional testing required due to previously failed tests.

3. All concrete anchors shall be installed in strict conformance with the manufacturer's printed installation instructions. A representative of the manufacturer shall be on site when required by the Engineer.

4. All holes shall be drilled in accordance with the manufacturer's instructions except that cored holes shall not be allowed unless specifically approved by the Engineer. If cored holes are allowed, cored holes shall be roughened in accordance with

manufacturer requirements. Thoroughly clean drill holes of all debris, drill dust, and water in accordance with the manufacturer's instructions prior to installation of adhesive and threaded rod unless otherwise recommended by the manufacturer. Degree of hole dampness shall be in strict accordance with manufacturer recommendations. Installation conditions shall be either dry or water saturated. Water filled or submerged holes shall not be permitted unless specifically approved by the Engineer. Injection of adhesive into the hole shall be performed to minimize the formation of air pockets in accordance with the manufacturer's instructions. Wipe rod free from oil that may be present from shipping or handling.

5. All adhesive anchor installations in the horizontal to vertically overhead orientation shall be conducted by a certified Adhesive Anchor Installer as certified by ACI/CSRI per ACI 318-11 D.9.2.2. Current AAI Certificate must be submitted to the Engineer of Record prior to commencement of any adhesive anchor installations*.*

E. Other Bolts

1. All dissimilar metal shall be connected with appropriate fasteners and shall be isolated via an approved dielectric.

2. All stainless-steel bolts shall be coated with anti-seize lubricant.

3.03 WELDING

A. All welding shall comply with AWS Code for procedures, appearance, quality of welds, qualifications of welders and methods used in correcting welded work.

B. Welded stud connectors shall be installed in accordance with AWS D1.1.

C. Welds shown on the Drawings with a field weld symbol shall be field welded. All other welds shall be shop welded unless specifically approved by the Engineer.

3.04 INSPECTION

A. High strength bolting will be visually inspected in accordance with RCSC "Specification for Structural Joints Using High Strength Bolts". Rejected bolts shall be either replaced or retightened as required.

B. Field welds will be visually inspected in accordance with AWS Codes. Inadequate welds shall be corrected or redone as required in accordance with AWS Codes.

C. Post-installed concrete anchors shall be inspected as required by ACI 318.

3.05 CUTTING OF EMBEDDED REBAR

A. The Contractor shall not cut embedded rebar cast into structural concrete during installation of post-installed fasteners without prior approval of the Engineer.

END OF SECTION

SECTION 05 10 00
METAL MATERIALS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Metal materials not otherwise specified shall conform to the requirements of this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Requirements for specific products made from the materials specified herein are included in other sections of the Specifications, including, but not limited to the Sections listed below. See the Section for the specific item in question.

1. Section 05 05 23 – Metal Fastening, includes materials for fasteners.

2. Section 05 14 00 – Structural Aluminum

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. ASTM A36 – Standard Specification for Structural Steel

B. ASTM A47 – Standard Specification for Malleable Iron Castings

C. ASTM A48 – Standard Specification for Gray Iron Castings

D. ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

E. ASTM A167 – Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

F. ASTM A276 – Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes

G. ASTM A307 – Standard Specification for Carbon Steel Externally Threaded Standard Fasteners

H. ASTM A446 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) quality

I. ASTM A500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

J. ASTM A501 – Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

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K. ASTM A529 – Standard Specification for Structural Steel with 42 000 psi (290 Mpa) Minimum Yield Point (1/2 in. (12.7 mm) Maximum Thickness)

L. ASTM A536 – Standard Specification for Ductile Iron Castings

M. ASTM A570 – Standard Specification for Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality

N. ASTM A572 – Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel

O. ASTM A992 – Standard Specification for Structural Steel Shapes

P. ASTM A666 – Standard Specification for Austenitic Stainless Steel, Sheet, Strip, Plate, and Flat Bar for Structural Applications

Q. ASTM A1085 – Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS)

R. ASTM B26 – Standard Specification for Aluminum-Alloy Sand Castings

S. ASTM B85 – Standard Specification for Aluminum-Alloy Die Castings

T. ASTM B108 – Standard Specification for Aluminum-Alloy Permanent Mold Castings

U. ASTM B138 – Standard Specification for Manganese Bronze Rod, Bar, and Shapes

V. ASTM B209 – Standard Specification for Aluminum-Alloy Sheet and Plate

W. ASTM B221 – Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

X. ASTM B308 – Standard Specification for Aluminum-Alloy Standard Structural Shapes, Rolled or Extruded

Y. ASTM B574 – Standard Specification for Nickel-Molybdenum-Chromium Alloy Rod

Z. ASTM F468 - Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use

AA. ASTM F593 – Standard Specification for Stainless Steel Fasteners

1.04 SUBMITTALS

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A. Material certifications shall be submitted along with any shop drawings for metal products and fabrications required by other sections of the Specifications.

1.05 QUALITY ASSURANCE

A. Owner may engage the services of a testing agency to test any metal materials for conformance with the material requirements herein. If the material is found to be in conformance with Specifications the cost of testing will be borne by the Owner. If the material does not conform to the Specifications, the cost of testing shall be paid by the Contractor and all materials not in conformance as determined by the Engineer shall be replaced by the Contractor at no additional cost to the Owner. In lieu of replacing materials, the Contractor may request further testing to determine conformance, but any such testing shall be paid for by the Contractor regardless of outcome of such testing.

PART 2 – PRODUCTS

2.01 CARBON AND LOW ALLOY STEEL

A. Material types and ASTM designations shall be as listed below:

Steel W, C, and MC Shapes	A992
Steel HP Shapes	A572 Grade 50
Steel M and S shapes and Angles, Bars, and Plates	A36
Rods	F 1554 Grade 36
Pipe - Structural Use	A53 Grade B
Hollow Structural Sections	A500 Grade C or A1085 Grade A
Cold-Formed Steel Framing	A 653

2.02 STAINLESS STEEL

A. All stainless steel fabrications exposed to underwater service shall be Type 316. All other stainless steel fabrications shall be Type 304, unless noted otherwise.

B. Material types and ASTM designations are listed below:

Plates and Sheets	ASTM A167 or A666 Grade A
Structural Shapes	ASTM A276
Fasteners (Bolts, etc.)	ASTM F593

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2.03 ALUMINUM

A. All aluminum shall be alloy 6061-T6, unless otherwise noted or specified herein.

B. Material types and ASTM designations are listed below:

Structural Shapes	ASTM B308
Castings	ASTM B26, B85, or B108
Extruded Bars	ASTM B221 - Alloy 6061
Extruded Rods, Shapes and Tubes	ASTM B221 - Alloy 6063
Plates	ASTM B209 - Alloy 6061
Sheets	ASTM B221 - Alloy 3003

C. All aluminum structural members shall conform to the requirements of Section 05 14 00 – Structural Aluminum.

D. All aluminum shall be provided with mill finish unless otherwise noted.

E. Where bolted connections are indicated, aluminum shall be fastened with stainless steel bolts.

2.04 CAST IRON

A. Material types and ASTM designations are listed below:

Gray	ASTM A48 Class 30B
Malleable	ASTM A47
Ductile	ASTM A536 Grade 60-40-18

2.05 BRONZE

A. Material types and ASTM designations are listed below:

Rods, Bars and Sheets	ASTM B138 - Alloy B Soft

2.06 HASTELLOY

A. All Hastelloy shall be Alloy C-276.

2.07 DISSIMILAR METALS

A. Dielectric isolation shall be installed wherever dissimilar metals are connected according to the following table.

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	Zinc	Galvanized Steel	Aluminum	Cast Iron	Ductile Iron	Mild Steel/ Carbon Steel	Copper	Brass	Stainless Steel
Zinc			●	●	●	●	●	●	●
Galvanized Steel			●	●	●	●	●	●	●
Aluminum	●	●		●	●	●	●	●	●
Cast Iron	●	●	●				●	●	●
Ductile Iron	●	●	●				●	●	●
Mild Steel/ Carbon Steel	●	●	●				●	●	●
Copper	●	●	●	●	●	●			●
Brass	●	●	●	●	●	●			●
Stainless Steel	●	●	●	●	●	●	●	●	

1. "●" signifies dielectric isolation is required between the two materials noted.
2. Consult Engineer for items not listed in table.

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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NO TEXT ON THIS PAGE

SECTION 05 12 00

STRUCTURAL STEEL

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Furnish all equipment, labor, materials, and services required to provide all structural steel work in accordance with the Contract Documents. The term "structural steel" shall include items as defined in the AISC "Code of Standard Practice".

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03 60 00 – Grout

B. Section 05 05 13 – Galvanizing

C. Section 05 05 23 – Metal Fastening

D. Section 05 10 00 – Metal Materials

E. Section 09 90 00 – Painting

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of the Specifications, all work specified herein shall conform to the applicable requirements of the following documents.

1. New York State Building Code
2. AISC – "Code of Standard Practice"
3. AISC – "Specification for Structural Steel Buildings"
4. AISC – RCSC “Specification for Structural Joints Using High Strength Bolts”
5. AWS – "Structural Welding Code"
6. ASTM A786 – Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures.

1. Certified Mill Test Reports
2. Affidavit of Compliance with grade specified
3. Shop Drawings which include the following:

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a. Layout drawings indicating all structural shapes, sizes, and dimensions.

b. Beam and column schedules.

c. Detailed drawings indicating jointing, anchoring and connection details and vent and drain holes where required.

4. Structural Steel Survey

1.05 QUALITY ASSURANCE

A. Shop inspection may be required by the Owner at his own expense. The Contractor shall give ample notice to the Engineer prior to the beginning of any fabrication work so that inspection may be provided. The Contractor shall furnish all facilities for the inspection of materials and workmanship in the shop, and the inspectors shall be allowed free access to the necessary parts of the work. Inspectors shall have the authority to reject any materials or work which do not meet the requirements of these Specifications. Inspection at the shop is intended as a means of facilitating the work and avoiding errors, but is expressly understood that it will in no way relieve the Contractor from his responsibility for furnishing proper materials or workmanship under this Specification.

B. The structural steel erector shall be a qualified installer who participates in the AISC Certification program and is designated an AISC Certified Erector.

C. The structural steel fabricator shall be a qualified fabricator who participates in the AISC Certification program and is designated an AISC Certified Building Fabricator.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Structural Steel

1. Structural steel for W, C, and MC shapes shall conform to ASTM A992 unless otherwise indicated.

2. Structural steel for HP shapes shall conform to ASTM A572 Grade 50 unless otherwise indicated.

3. Structural steel for S and M shapes and angles and plates shall conform to ASTM A36 unless otherwise indicated.

4. Steel pipe shall be ASTM A53, Grade B.

5. HSS shall be ASTM A500, Grade C or ASTM A1085. All members shall be furnished full length without splices unless otherwise noted or accepted by the Engineer.

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6. All unidentified steel will be rejected and shall be removed from the site and replaced by the Contractor, all at the expense of the Contractor.

7. Fasteners for structural steel shall be in accordance with Section 05 05 23 – Metal Fastening.

B. Welds

1. Electrodes for welding shall be in accordance with Section 05 05 23 – Metal Fastening.

PART 3 – EXECUTION

3.01 MEASUREMENT

A. The Contractor shall verify all dimensions and shall make any field measurements necessary and shall be fully responsible for accuracy and layout of work. The Contractor shall review the Drawings and any discrepancies shall be reported to the Engineer for clarification prior to starting fabrication.

3.02 FABRICATION

A. Fabrication shall be in accordance with the AISC "Specification for Structural Steel Buildings and AISC "Code of Standard Practice". Fabrication shall begin only after Shop Drawing approval.

B. Except where otherwise noted on the Drawings or in this Specification, all shop connections shall be welded.

C. All holes in structural steel members required for anchors, anchor rods, bolts, sag rods, vent and drain holes or other members or for attachment of other work shall be provided by the fabricator and detailed on the Shop Drawings.

D. All materials shall be properly worked and match-marked for field assembly.

E. Where galvanizing of structural steel is required, galvanizing shall be done in accordance with Section 05 05 13 – Galvanizing.

F. Checkered floor plate shall meet the requirements of ASTM A786.

3.03 DELIVERY, STORAGE AND HANDLING

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A. Structural members shall be loaded in such a manner that they may be transported and unloaded without being over-stressed, deformed or otherwise damaged.

B. Structural steel members and packaged materials shall be protected from corrosion and deterioration. Material shall be stored in a dry area and shall not be placed in direct

contact with the ground. Materials shall not be placed on the structure in a manner that might cause distortion or damage to the members or the supporting structures. The Contractor shall repair or replace damaged materials or structures as directed.

3.04 ERECTION

A. The erection of all structural steel shall conform to the applicable requirements of the AISC "Specification for Structural Steel Buildings" and AISC "Code of Standard Practice". All temporary bracing, guys and bolts as may be necessary to ensure the safety of the structure until the permanent connections have been made shall be provided by the Contractor.

B. Structural members shall be set accurately to the lines and elevations indicated. The various members shall be aligned and adjusted to form a part of a complete frame or structure before permanently fastened. A licensed land surveyor shall survey the structural steel during erection and shall provide a final survey indicating elevations and locations of all major members. Necessary adjustments to compensate for discrepancies in elevations and alignments shall be performed.

C. No cutting of structural steel members in the field will be allowed except by the written approval of the Engineer.

D. Bearing surfaces and other surfaces which will be in permanent contact shall be cleaned before assembly.

E. Field welding shall not be permitted unless specifically indicated in the Drawings or approved in writing by the Engineer. All field welding shall comply with Section 05 05 23 – Metal Fastening.

F. All bolted connections shall use high strength bolts in accordance with Section 05 05 23 – Metal Fastening. High strength bolts shall be installed in accordance with RCSC “Specification for Structural Joints Using High Strength Bolts”. Bolts specified or noted on the Drawings to be a tension or slip critical “SC” type connection shall be fully pretensioned with proper preparation of the faying surfaces. All other bolts shall be snug tightened unless otherwise noted on the Drawings.

G. All field connections shall be accurately fitted up before being bolted. Drifting shall be only such as will bring the parts into position and shall not be sufficient to enlarge the holes or to distort the metal. All unfair holes shall be drilled or reamed.

H. Misfits at Bolted Connections

1. Where misfits in erection bolting are encountered, the Engineer shall be immediately notified. The Contractor shall submit a method to remedy the misfit for review by the Engineer. The Engineer will determine whether the remedy is acceptable or if the member must be refabricated.

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2. Incorrectly sized or misaligned holes in members shall not be enlarged by burning or by the use of drift pins. The Contractor shall notify the Engineer immediately and shall submit a proposed method of remedy for review by the Engineer.

3. Where misalignment between anchor rods and rod holes in steel members are encountered, the Engineer shall be immediately notified. The Contractor shall submit a method to remedy the misalignment for review by the Engineer.

I. Grouting of Base Plates and Bearing Plates

1. The bottom surface of the plates shall be cleaned of all foreign materials, and concrete or masonry bearing surface shall be cleaned of all foreign materials and roughened to improve bonding.

2. Accurately set all base and bearing plates to designated levels with steel wedges or leveling plates.

3. Baseplates shall be grouted with non-shrink grout to assure full uniform bearing. Grouting shall be done prior to placing loads on the structure. Non-shrink grout shall conform to Section 03 60 00 – Grout.

4. Anchor rods shall be tightened after the supported members have been positioned and plumbed and the non-shrink grout has attained its specified strength.

J. Where finishing is required, assembly shall be completed including bolting and welding of units before start of finishing operations.

3.05 PAINTING

A. Painting shall be performed according to Section 09 90 00 – Painting and the following additional requirements.

1. Concrete Encased Steel: Steel members which will be encased in concrete shall be cleaned but not painted prior to encasement.

2. Contact Surfaces: Contact surfaces such as at field connections, shall be cleaned and primed but not painted.

3. Finished Surfaces: Machine finished surfaces shall be protected against corrosion by a rust-inhibiting coating which is easily removed prior to erection or which has characteristics that make removal unnecessary prior to erection.

4. Surfaces Adjacent to Field Welds: Surfaces within 2 inches of any field weld location shall be free of materials that would prevent proper welding or produce objectionable fumes while welding is being done.

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END OF SECTION

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SECTION 05 13 00

STAINLESS STEEL

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. The Contractor shall furnish, install and erect the stainless steel work as shown on the Contract Drawings and specified herein.

B. Stainless steel work shall be furnished complete with all accessories, mountings and appurtenances of the type of stainless steel and finish as specified or required for a satisfactory installation.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 05 05 23 – Metal Fastening

B. Section 05 10 00 – Metal Materials

C. Section 05 50 00 – Metal Fabrications

1.03 REFERENCES

A. ASTM A193 – Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service

B. ASTM A194 – Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service

C. ASTM A262 – Practice for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steel

D. ASTM A276 – Stainless and Heat-Resisting Steel Bars and Shapes

E. ASTM A314 – Stainless and Heat-Resisting Steel Billets and Bars for Forging

F. ASTM A380 – Practice for Cleaning and Descaling Stainless Steel Parts, Equipment and Systems

G. ASTM A473 – Stainless and Heat-Resisting Steel Forgings

H. ASTM A666 – Austenitic Stainless Steel, Sheet, Strip, Plate and Flat Bar

I. ASTM A774 – Stainless Steel Pipe Fittings

J. ASTM A778 – Stainless Steel Pipe

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K. ASTM A967 – Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts

L. ASTM F593 – Stainless Steel Bolts, Hex Cap Screws and Studs

M. ASTM F594 – Stainless Steel Nuts

N. ANSI/ASME B1.1 – Unified Inch Screw Thread (UN and UNR Thread Form)

1.04 TESTS

A. All stainless steel materials including stainless test welds, shall be checked for compliance with tests for susceptibility to intergranular attack. Such tests shall be Practices A, B and E of ASTM A262. Detailed procedures for the tests shall be submitted to the Engineer for approval prior to start of work. Practice A shall be used only for acceptance of materials but not for rejection of materials, and shall be used for screening material intended for testing in Practice B and Practice E. The maximum acceptable corrosion rate under Practice B shall be 0.004 inch per month, rounded off to the third decimal place. If the certified mill report indicates that such test has been satisfactory performed, the fabricator may not be required to repeat the test. Material passing Practice E shall be acceptable.

B. Sample selection for the susceptibility to intergranular attack tests shall be as follows:

1. One (1) sample per heat treatment lot for plates and forgings;

2. One (1) sample per each Welding Procedure Qualification regardless of the joint design;

3. If tests indicate a reduction in corrosion resistance, welding procedure shall be adjusted or heat treatment determined as needed to restore required corrosion resistance.

4. The samples so chosen shall have received all the post-weld heat treatments identical to the finished part.

1.05 SUBMITTALS

A. The Contractor shall prepare and submit for approval shop drawings for all stainless steel fabrication in accordance with Section 01 33 00 – Submittal Procedures.

B. Submittals shall include, but not be limited to, the following:

1. Certified test reports for susceptibility to intergranular attack.

2. Affidavit of compliance with type of stainless steel shown on the Contract Drawings or specified herein.

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3. Certified weld inspection reports.

4. Cleaning and handling of stainless steel in accordance with Paragraph 3.04, Cleaning and Handling.

C. Samples of finish, on each type of stainless steel to be furnished, shall be submitted to the Engineer upon request.

1.06 QUALITY ASSURANCE

A. Shop inspections may be made by the Engineer. The Contractor shall give ample notice to the Engineer prior to the beginning of any stainless steel fabrication work so that inspection may be provided. The Contractor shall furnish all facilities for the inspection of materials and workmanship in the shop, and the inspectors shall be allowed free access to the necessary parts of the works.

B. Inspectors shall have the authority to reject any materials or work which does not meet the requirements of the Contract Drawings or the Specifications.

C. Inspection at the shop is intended as a means of facilitating the work and avoiding errors, but is expressly understood that it will in no way relieve the Contractor from his responsibility for furnishing proper materials or workmanship.

1.07 HANDLING, STORAGE AND DELIVERY

A. Mechanical damage (e.g., scratches and gouges) to the stainless steel material shall not be permitted and is cause for rejection. Care shall be taken in the material handling since such mechanical damage will result in the passive oxide film being "punctured" leading to a possible lower resistance to the initiation of corrosion than the surrounding chemically-passivated surface.

B. Stainless steel plates and sheets shall be stored vertically in racks and not be dragged out of the racks or over one another. Racks shall be protected to prevent iron contamination.

C. Heavy stainless steel plates shall be carefully separated and chocked with wooden blocks so that the forks of a fork-lift could be inserted between plates without mechanically damaging the surface.

D. Stainless steel plates and sheets laid out for use shall be off the floor and be divided by wooden planks to prevent surface damage and to facilitate subsequent handling.

E. Plate clamps, if used, shall be used with care as the serrated faces can dig in, indent and gouge the surface.

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F. Stainless steel fabrications shall be loaded in such a manner that they may be transported and unloaded without being overstressed, deformed or otherwise damaged.

G. Stainless steel fabrications and packaged materials shall be protected from corrosion and deterioration and shall be stored in a dry area. Materials stored outdoors shall be supported above ground surfaces on wood runners and protected with approved effective and durable covers.

H. Stainless steel fabrications shall not be placed in or on a structure in a manner that might cause distortion or damage to the fabrication. The Contractor shall repair or replace damaged stainless steel fabrications or materials as directed by the Engineer.

1.08 FIELD MEASUREMENTS

A. The Contractor shall verify all dimensions and shall make any field measurements necessary and shall be fully responsible for accuracy and layout of the work.

B. The Contractor shall review the Contract Drawings and any discrepancies shall be reported to the Engineer for clarification prior to starting fabrication.

PART 2 – PRODUCTS

2.01 MATERIALS AND FINISHES

A. Stainless steel shall be Type 304 unless it is used for underwater service. Stainless steel for underwater service shall be Type 316. Minimum mechanical finish shall be No. 4 as stated in Table 2 unless otherwise noted on the Contract Drawings.

B. The basic mill forms (sheet, strip, plate and bar) are classified by size as shown on Table 1. Tables 2, 3 and 4 identify finishes and conditions in which sheet, bar and plate are available.

C. Tables 2, 3 and 4 show numbered finishes and conditions for sheet, bar and plate. While there are no specific designations for polished finishes on bar or plate, the sheet finish designations are used to describe the desired effect. This also applies to finishes on ornamental tubing.

D. There are three standard finishes for strip, which are broadly described by the finishing operations employed:

1. No. 1 Strip Finish is approximately the same as No. 2D Sheet Finish. It varies in appearance from dull gray matte to a fairly reflective surface, depending largely on alloy composition and amount of cold reduction.

2. No. 2 Strip Finish is approximately the same as a No. 2B sheet finish. It is smoother, more reflective than No. 1, and likewise varies with alloy composition.

3. Bright annealed finish is a highly reflective finish that is retained by final annealing in a controlled atmosphere furnace.

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Table 1: Classification of Stainless Steel Product Form

Item	Description	Dimensions		
		Thickness	Width	Diameter or Size
Sheet	Coils and cut length:			
	Mill finishes Nos. 1, 2D and 2B	under 3/16"	24" and over all widths	-
	Polished finishes Nos. 3, 4, 6, 7 & 8			
Strip	Cold finished, coils or cut lengths:			
	Polished finishes Nos. 3, 4, 6,7 & 8	under 3/16"	under 24" all widths	-
Plate	Flat rolled or forged	3/16" and over	over 10"	-
Bar	Hot finished rounds, squares, octagons and hexagons	-	-	1/4" and over
	Hot finished flats	1/8" to 8" incl.	1/4" to 10" incl.	-
	Cold finished rounds, squares, octagons and hexagons	-	-	over 1/8"
	Cold finished flats	1/8" to 4-1/2"	3/8" to 4-1/2"	-
Wire	Cold finishes only: (in coil)			
	Round, square, octagon, hexagon and flat wire	under 3/16"	under 3/8"	-
Pipe & Tubing	Several different classifications, with differing specifications, are available.			
Extrusion	Not considered “standard” shapes. Currently limited in size to approximately 6-1/2" diameter or structurals.			

Table 2: Standard Mechanical Sheet Finishes

Unpolished or Rolled Finishes		Polished Finishes	
No. 1	A rough dull surface which results from hot rolling to the specified thickness followed by annealing and descaling.	**No. 3**	An intermediate polish surface obtained by finishing with a 100 grit abrasive. Generally used where a semi-finished polished surface is required. A No. 3 finish usually receives additional polishing during fabrication
No. 2D	A dull finish which results from cold rolling followed by annealing and descaling, and may perhaps get a final light roll pass through unpolished rolls. A 2D finish is used where appearance is of no concern.	**No. 4**	A polished surface obtained by finishing with a 120-150 mesh abrasive, following initial grinding with coarser abrasives. This is a general purpose bright finish with a visible "grain" which prevents mirror reflection.
No. 2B	A bright cold-rolled finish resulting in the same manner as No. 2D finish, except that the annealed and descaled sheet receives a final light roll pass through polished rolls. This is the general purpose cold-rolled finish that can be used as is, or as a preliminary step to polishing.	**No. 6**	A dull satin finish having lower reflectivity than No. 4 finish. It is produced by Tampico brushing the No. 4 finish in a medium of abrasive and oil. It is used for architectural applications and ornamentation where a high luster is undesirable, and to contrast with brighter finishes.
		No. 7	A high reflective finish that is obtained by buffing finely ground surfaces but not to the extent of completely removing the "grit" lines. It is used chiefly for architectural and ornamental purposes.
		No. 8	The most reflective surface, which is obtained by polishing with successively finer abrasives and buffing extensively until all grit lines from preliminary grinding operations are removed. It is used for applications such as mirrors and reflectors.

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Table 3: Conditions and Finishes for Bar

Conditions	Surface Finishes[1]
Hot worked only	(a) Scale not removed (excluding spot conditioning) (b) Rough turned[2] (c) Pickled or blast cleaned and pickled.
Annealed or otherwise heat treated	(a) Scale not removed (excluding spot conditioning) (b) Rough turned (c) Pickled or blast cleaned and pickled (d) Cold drawn or cold rolled (e) Centerless ground (f) Polished
Annealed and cold worked to high tensile strength[3]	(a) Cold drawn or cold rolled (b) Centerless ground (c) Polished

Table 4: Conditions and Finishes for Plate

Condition and Finish	Description and Remarks
Hot rolled	Scale not removed. Not heat treated. Plates not recommended for final use in this condition.[4]
Hot rolled, annealed or heat treated	Scale not removed. Use of plates in this condition is generally confined to heat resisting applications. Scale impairs corrosion resistance.[1]
Hot rolled, annealed or heat treated, blast cleaned or pickled	Condition and finish commonly preferred for corrosion resisting and most heat resisting applications.
Hot rolled, annealed, descaled and temper passed	Smoother finish for specialized applications.
Hot rolled, annealed, descaled cold rolled, annealed, descaled, optionally temper passed	Smooth finish with greater freedom from surface imperfection than the above.
Hot rolled, annealed or heat treated, surface cleaned and polished	Polished finishes refer to Table 2.

[1] Surface finishes (b), (e) and (f) are applicable to round bars only.

[2] Bars of the 4xx series stainless steels which are highly hardenable, such as Types 414, 420, 420F, 431, 440A, 440B and 440C, are annealed before rough turning. Other hardenable grades, such as Types 403, 410, 416 and 416Se, may also require annealing depending on their composition and size.

[3] Produced in Types 302, 303Se, 304 and 316.

[4] Surface inspection is not practicable on plates which have not been pickled or otherwise descaled.

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PART 3 – EXECUTION

3.01 FABRICATION

A. Holes for bolts and screws shall be drilled. Fastenings shall be concealed where practicable. Joints exposed to the weather shall be formed to exclude water.

B. As far as practicable, all fabricated units shall be fitted and assembled in the shop, with all cuts and bends made to precision measurements in accordance with details shown on approved shop drawings.

C. Work shall be fabricated so that it is installed in a manner that will provide for expansion and contraction, prevent the shearing of bolts, screws and other fastenings, ensure rigidity, and provide close fitting of sections.

D. All finished and/or machined faces shall be true to line and level. Stainless steel sections shall be well formed to shape and size with sharp lines and angles; curved work shall be sprung evenly to curves.

E. All work shall be fitted together at the shop as far as possible, and delivered complete and ready for erection. Proper care shall be exercised in handling all work so as not to injure the finished surfaces.

3.02 WELDING

A. Welding shall be done in a manner that will prevent buckling and in accordance with Section 05 05 23 – Metal Fastening, and as modified hereinafter.

B. All welds exposed in the work shall be ground smooth and finished to match the finish of the adjacent stainless steel surfaces.

C. Select weld rods that provide weld filler metal having corrosion resistant properties as nearly identical or better than the base metal to insure preservation of the corrosion-resistant properties. Provide heat treatment at welds where testing of weld procedure indicates it is required to restore the corrosion resistance.

D. Thermal conductivity of stainless steel is about half that of other steels; and the following methods may be used to accommodate this situation:

1. Use lower weld current setting.

2. Use skip-weld techniques to minimize heat concentration.

3. Use back-up chill bars or other cooling techniques to dissipate heat.

E. Edges of the stainless steel to be welded shall be cleaned of contaminants.

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3.03 FASTENERS

A. Stainless steel fasteners shall be used for joining stainless steel work.

B. Stainless steel fasteners shall be made of alloys that are equal to or more corrosion resistant than the materials they join.

3.04 CLEANING AND HANDLING

A. All stainless steel surfaces shall be precleaned, descaled, passivated and inspected before, during and after fabrication in accordance with the applicable sections of ASTM A380 and as detailed in the procedures to be submitted to the Engineer for approval prior to start of work. Chemical passivation in accordance with ASTM A967 is required for all stainless steel in contact with process water. Degreasing and passivation of stainless steel articles shall be conducted as the last step after fabrication.

B. Measures to protect cleaned surfaces shall be taken as soon as final cleaning is completed and shall be maintained during all subsequent handling, storage and shipping.

1. The Contractor shall submit for approval specific procedures listing all the steps to be followed in detecting contamination and in descaling, cleaning, passivation and protecting of all stainless steel.

2. Area showing clear indications of contamination shall be recleaned, repassivated and reinspected.

C. At approved stages in the shop operations, contaminants such as scale, embedded iron, rust, dirts, oil, grease and any other foreign matter shall be removed from the metal, as directed or approved by the Engineer. The adequacy of these operations shall be checked by the Engineer. Operations in the shop shall be conducted so as to avoid contamination of the stainless steel and to keep the metal surfaces free from dirt and foreign matter.

D. In order to prevent incipient corrosion during fabrication, special efforts shall be made at all times to keep all stainless steel surfaces from coming in contact with other metals.

1. Stainless steel and stainless steel welds shall be cleaned with clean sand free of iron, stainless steel wool, stainless steel brushes, or other approved means and shall be protected at all times from contamination by any materials, including carbon steel, that shall impair its resistance to corrosion.

2. Approved methods of cutting, grinding and handling shall be used to prevent contamination. If air-arc, or carbon-arc cutting is used, additional metal shall be removed by approved mechanical means so as to provide clean, weldable edges. All grinding of stainless steel shall be performed with aluminum oxide or silicon

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carbide grinding wheels bonded with resin or rubber. Grinding wheels used on carbon steel shall not be used on stainless steel.

3. Sand, grinding wheels, brushes and other materials used for cleaning stainless steel shall be checked periodically by the Engineer for contaminants. Cleaning aids found to contain contaminants shall not be used on the work.

3.05 INSTALLATION

A. All stainless steel fabrications shall be erected square, plumb and true, accurately fitted, adequately anchored in place, set at proper elevations and positions.

B. All inserts, anchor rods and all other miscellaneous work specified in the Detailed Specifications or shown on the Contract Drawings or required for the proper completion of the work, which are embedded in concrete, shall be properly set and securely held in position in the forms before the concrete is placed.

C. All stainless steel fabrications shall be installed in conformance with details shown on the Contract Drawings or on the approved shop drawings.

END OF SECTION

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SECTION 05 14 00

STRUCTURAL ALUMINUM

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Furnish all equipment, labor, materials, and services required to provide all structural aluminum work in accordance with the Contract Documents. The term "structural aluminum" shall include items as defined in the Aluminum Association "Specifications for Aluminum Structures".

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03 60 00 – Grout

B. Section 05 05 23 – Metal Fastening

C. Section 05 10 00 – Metal Materials

D. Section 09 90 00 – Painting

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of other requirements of the Specifications, all work specified herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of the Bid.

1. New York State Building Code

2. Aluminum Association "Specifications for Aluminum Structures"

3. AWS D1.2 – "Structural Welding Code"

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures.

1. Certified Mill Test Reports

2. Affidavit of Compliance with grade specified

3. Shop Drawings which include the following:

a. Layout drawings indicating all structural shapes, sizes, and dimensions.

b. Beam and column schedules.

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c. Detailed drawings indicating jointing, anchoring and connection details.

1.05 QUALITY ASSURANCE

A. Shop inspection may be required by the Owner at his own expense. The Contractor shall give ample notice to the Engineer prior to the beginning of any fabrication work so that inspection may be provided. The Contractor shall furnish all facilities for the inspection of materials and workmanship in the shop, and the inspectors shall be allowed free access to the necessary parts of the work. Inspectors shall have the authority to reject any materials or work which do not meet the requirements of these Specifications. Inspection at the shop is intended as a means of facilitating the work and avoiding errors, but is expressly understood that it will in no way relieve the Contractor from his responsibility for furnishing proper materials or workmanship under this Specification.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Structural aluminum shall comply with Section 05 10 00 – Metal Materials.

B. Fasteners for structural aluminum shall be in accordance with Section 05 05 23 – Metal Fastening.

C. Electrodes for welding shall be in accordance with Section 05 05 23 – Metal Fastening.

PART 3 – EXECUTION

3.01 MEASUREMENT

A. The Contractor shall verify all dimensions and shall make any field measurements necessary and shall be fully responsible for accuracy and layout of work. The Contractor shall review the Drawings and any discrepancies shall be reported to the Engineer for clarification prior to starting fabrication.

3.02 FABRICATION

A. Fabrication shall be in accordance with the Aluminum Association "Specifications for Aluminum Structures". Fabrication shall begin only after Shop Drawing approval.

B. Except where otherwise noted on the Drawings or in this Specification, all shop connections shall be welded.

C. All holes in structural aluminum members required for anchors, anchor rods, bolts, or other members or for attachment of other work shall be provided by the fabricator and detailed on the Shop Drawings.

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D. All materials shall be properly worked and match-marked for field assembly.

3.03 DELIVERY, STORAGE AND HANDLING

A. Structural members shall be loaded in such a manner that they may be transported and unloaded without being over-stressed, deformed or otherwise damaged.

B. Structural aluminum members and packaged materials shall be protected from corrosion and deterioration. Material shall be stored in a dry area and shall not be placed in direct contact with the ground. Materials shall not be placed on the structure in a manner that might cause distortion or damage to the members or the supporting structures. The Contractor shall repair or replace damaged materials or structures as directed.

3.04 ERECTION

A. All temporary bracing, guys and bolts as may be necessary to ensure the safety of the structure until the permanent connections have been made shall be provided by the Contractor.

B. Structural members shall be set accurately to the lines and elevations indicated. The various members shall be aligned and adjusted to form a part of a complete frame or structure before being permanently fastened. A licensed land surveyor shall survey the structural aluminum during erection and shall provide a final survey indicating elevations and locations of all major members. Necessary adjustments to compensate for discrepancies in elevations and alignments shall be performed.

C. No cutting of structural aluminum members in the field will be allowed except by the written approval of the Engineer.

D. Bearing surfaces and other surfaces which will be in permanent contact shall be cleaned before assembly.

E. Field welding shall not be permitted unless specifically indicated in the Drawings or approved in writing by the Engineer. All field welding shall comply with Section 05 05 23 – Metal Fastening.

F. All bolted connections shall comply with Section 05 05 23 – Metal Fastening.

G. All field connections shall be accurately fitted up before being bolted. Drifting shall be only such as will bring the parts into position and shall not be sufficient to enlarge the holes or to distort the metal. All unfair holes shall be drilled or reamed.

H. Misfits at Bolted Connections

1. Where misfits in erection bolting are encountered, the Engineer shall be immediately notified. The Contractor shall submit a method to remedy the misfit for

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review by the Engineer. The Engineer will determine whether the remedy is acceptable or if the member must be refabricated.

2. Incorrectly sized or misaligned holes in members shall not be enlarged by burning or by the use of drift pins. The Contractor shall notify the Engineer immediately and shall submit a proposed method of remedy for review by the Engineer.

3. Where misalignment between anchor bolts and bolt holes in aluminum members are encountered, the Engineer shall be immediately notified. The Contractor shall submit a method to remedy the misalignment for review by the Engineer.

I. Grouting of Base Plates and Bearing Plates

1. The bottom surface of the plates shall be cleaned of all foreign materials, and concrete or masonry bearing surface shall be cleaned of all foreign materials and roughened to improve bonding.

2. Accurately set all base and bearing plates to designated levels with steel wedges or leveling plates.

3. Baseplates shall be grouted with non-shrink grout to assure full uniform bearing. Grouting shall be done prior to placing loads on the structure. Non-shrink grout shall conform to Section 03 60 00 – Grout.

4. Anchor bolts shall be tightened after the supported members have been positioned and plumbed and the non-shrink grout has attained its specified strength.

J. Where finishing is required, assembly shall be completed including bolting and welding of units before start of finishing operations.

3.05 PAINTING

A. Painting shall be performed according to Section 09 90 00 – Painting.

B. Aluminum surfaces in contact with concrete or dissimilar metals shall be thoroughly protected with two coats of epoxy paint with a minimum total thickness of 16 mils or other approved isolating material in accordance with the requirements of Section 09 90 00 – Painting.

END OF SECTION

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SECTION 05 50 00

METAL FABRICATIONS

PART 1 – GENERAL

1.01 REQUIREMENT

A. Furnish all materials, labor, and equipment required to provide all metal fabrications not specifically included in other Sections, complete and in accordance with the requirements of the Contract Documents.

B. Work shall include but may not be limited to lintels, guard posts, hoppers, and chutes.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 05 05 13 – Galvanizing

B. Section 05 05 23 – Metal Fastening

C. Section 05 10 00 – Metal Materials

D. Section 05 12 00 – Structural Steel

E. Section 09 90 00 – Painting

F. Certain specific items are included in other Sections of the Specifications. See the section for the specific item in question.

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of other requirements of the Specifications, all work specified herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. New York State Building Code

2. AISC – Specification for Structural Steel Buildings

3. AISI – Specifications for the Design of Cold-Formed Steel Structural Members

4. Aluminum Association Specifications for Aluminum Structures

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures.

1. Complete fabrication and erection drawings of all metalwork specified herein.

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2. Other submittals as required in accordance with Section 05 10 00 – Metal Materials and Section 05 05 23 – Metal Fastening.

PART 2 – PRODUCTS

2.01 METAL MATERIALS

A. Metal materials used in metal fabrications shall conform to Section 05 10 00 – Metal Materials, unless noted otherwise.

2.02 METAL FASTENING

A. All welds and fasteners used in metal fabrication shall conform to Section 05 05 23 – Metal Fastening, unless noted otherwise.

2.03 LINTELS

A. Provide lintels as shown on the Drawings and specified herein with 8 inches minimum bearing each side unless noted otherwise.

B. All lintels shall be steel in accordance with Section 05 12 00 – Structural Steel and shall be galvanized in accordance with Section 05 05 13 – Galvanizing, unless noted otherwise.

2.04 GUARD POSTS (BOLLARDS)

A. Guard posts shall be 6-inch diameter Schedule 40 galvanized steel pipe in accordance with ASTM A53.

B. Guard posts shall be concrete filled and crowned, as detailed in the Drawings.

2.05 STAINLESS STEEL BAR RACKS AND RAKES:

A. Provide manually cleaned bar racks as shown on the Drawings.

B. Fabricate of all – stainless steel welded construction in accordance with the details on the Drawings.

C. Bar size and spacing shall provide clear openings as shown.

D. Provide plates, angles, bars, and fasteners as shown.

E. Provide approved rake of suitable length and spacing to match rack dimensions.

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PART 3 – EXECUTION

3.01 FABRICATION

A. All measurements and dimensions shall be based on field conditions and shall be verified by the Contractor prior to fabrication. Such verification shall include coordination with adjoining work.

B. All fabricated work shall be shop fitted together as much as practicable, and delivered to the field, complete and ready for erection. All miscellaneous items such as stiffeners, fillets, connections, brackets, and other details necessary for a complete installation shall be provided.

C. All work shall be fabricated and installed in a manner that will provide for expansion and contraction, prevent shearing of bolts, screws, and other fastenings, ensure rigidity, and provide a close fit of sections.

D. Finished members shall conform to the lines, angles, and curves shown on the Drawings and shall be free from distortions of any kind.

E. All shearings shall be neat and accurate, with parts exposed to view neatly finished. Flame cutting is allowed only when performed utilizing a machine.

F. All shop connections shall be welded unless otherwise indicated on the Drawings or specified herein. Bolts and welds shall conform to Section 05 05 23 – Metal Fastening. All fastenings shall be concealed where practicable.

G. Fabricated items shall be shop painted when specified in Section 09 90 00 – Painting.

3.02 INSTALLATION

A. Assembly and installation of fabricated system components shall be performed in strict accordance with manufacturer's recommendations.

B. All miscellaneous metalwork shall be erected square, plumb and true, accurately fitted, adequately anchored in place, and set at proper elevations and positions.

C. Metal work shall be field painted when as specified in accordance with Section 09 90 00 – Painting.

END OF SECTION

011705

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SECTION 05 51 00
METAL STAIRS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Furnish all materials, labor, and equipment required to provide all metal stairs in accordance with the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 05 05 13 – Galvanizing

B. Section 05 05 23 – Metal Fastening

C. Section 05 10 00 – Metal Materials

D. Section 05 12 00 – Structural Steel

E. Section 05 14 00 – Structural Aluminum

F. Section 05 52 00 – Guards and Railings

G. Section 05 53 00 – Gratings, Access Hatches, and Access Doors

H. Section 05 55 00 – Stair Treads and Nosings

I. Section 09 90 00 – Painting

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. New York State Building Code

2. AISC – Specification for Structural Steel Buildings

3. AISI – Specification for the Design of Cold-Formed Steel Structural Members

4. Aluminum Association Specifications for Aluminum Structures

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1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures.

1. Complete fabrication and erection drawings of all metal work specified herein.

2. Other submittals as required in accordance with Section 05 10 00 – Metal Materials and Section 05 05 23 – Metal Fastening.

3. Submit structural calculations and detailed erection drawings for steel pan stairs. Calculations and drawings shall be signed and sealed by a Professional Engineer currently registered in New York State.

PART 2 – PRODUCTS

2.01 METAL MATERIALS

A. Metal materials used for metal stairs shall conform to Section 05 10 00 – Metal Materials, unless noted otherwise.

2.02 METAL FASTENING

A. All welds and fasteners used in metal stairs shall conform to Section 05 05 23 – Metal Fastening, unless noted otherwise.

2.03 METAL STAIRS AND LANDINGS

A. Stair stringers and structural framing of landings shall be fabricated from steel or aluminum as indicated on the Drawings.

1. Steel stairs shall be fabricated from steel in accordance with Section 05 12 00 – Structural Steel.

2. Aluminum stairs shall be fabricated from aluminum alloy 6061-T6 in accordance with Section 05 14 00 – Structural Aluminum.

B. Regardless of material of stringers, all stair treads shall be aluminum in accordance with Section 05 55 00 – Stair Treads and Nosings.

C. Where metal landings are required as indicated on the Drawings, gratings at landings shall conform to Section 05 53 00 – Gratings, Access Hatches, and Access Doors.

D. Guards for metal stairs shall conform to Section 05 52 00 – Guards and Railings. Contractor shall coordinate attachment of guards to metal stairs.

E. All clips, anchors, and necessary appurtenances shall be provided for a complete and rigid installation.

F. Closure plates shall be provided for all exposed ends of stringers.

G. All exposed connections shall be welded and ground smooth, unless otherwise indicated on the Drawings.

H. Stairs and landings shall be designed to support a 100 psf live load, minimum, unless otherwise indicated on the Drawings.

2.04 STEEL PAN STAIRS

A. General

1. All steel stairs and landings with concrete filled steel pan risers and treads shall meet all applicable OSHA, ANSI, and NFPA codes.

2. Stair assemblies shall conform to the dimensions and arrangements shown on the Drawings.

3. Stair assemblies shall be designed to support a minimum 100 psf live load unless otherwise indicated on the Drawings.

4. Steel framing, hangers, columns, struts, clips, brackets, bearing plates, and other necessary appurtenances shall be provided for support of stairs and platforms as shown on the Drawings.

5. Exposed portions of steel pans, platforms, framing system stringers, and portions of aluminum nosings in contact with concrete, steel, or masonry shall be painted in accordance with Section 09 90 00 – Painting.

6. Concrete fill shall be 3-inches thick for platforms and 1-1/2 inches thick for pan treads.

7. Cast-in-place safety stair nosings in accordance with Section 05 55 00 – Stair Treads and Nosings, shall be provided for treads and platforms.

8. Metal pan treads, platforms, and risers shall be fabricated from 0.1084-inch thick (12 gauge minimum), galvanized structural steel sheets.

9. Risers and treads shall be supported by steel angle brackets welded to the stringers. Metal pans shall be secured to the brackets with welds.

10. Closure pieces shall be provided for ends of stringers.

11. Contractor shall be exclusively responsible for the design of steel pan stairs as shown on the Drawings including, but not limited to, treads, risers, landings, framing, hangers, beams, columns, struts, clips, brackets, bracing, bearing plates, connections (bolts, welds, concrete anchors, fasteners, etc.), guardrail, handrail, and other necessary components and appurtenances required for complete design and assembly of the steel pan stair system.

a. Steel pan stairs shall be designed for all applicable loads (dead, live, wind, seismic, snow, etc.) as required by the governing building code and ASCE 7. See Structural Drawings and as specified herein for minimum required loads and site-specific parameters. Design shall consider all loads, erection, temperature, and anchorage stresses.

b. All welds and fasteners used in steel pan stairs shall conform to Section 05 05 23 – Metal Fastening, unless noted otherwise.

c. Design of concrete anchors shall include design of anchor size, embedment, and edge distances.

B. Connections

1. All connections between steel components shall be welded unless otherwise shown on the Drawings or specified herein. All welds shall be continuous and ground smooth where exposed. Welding and fasteners shall conform to Section 05 05 23 – Metal Fastening.

2. Assemblies shall be fabricated such that bolts and other fastenings do not appear on finished surfaces.

3. All joints shall be true and tight, and connections between parts shall be light-proof tight.

C. Guards for steel pan stairs shall conform to Section 05 52 00 – Guards and Railings. Contractor shall coordinate connection of guards to stairs.

2.05 ALTERNATING TREAD STAIRS

A. Stairs, landings, and platforms shall be designed to carry a live load of 100 lbs. per square foot, unless noted otherwise on the Drawings.

B. The stairs shall be welded, alternating tread type stairs having a center spine and a cast integrally welded combination mounting plate and top landing, flush with the upper floor level. Handrails shall be custom formed and contoured to provide close body support and shall be welded on to the balusters which extend directly from the treads. All risers shall be equal, including the first and last risers, and treads shall have anti-skid surfaces. The stringer bottoms shall be bent and/or cut and welded to a floor plate. All exposed connections shall be welded and ground smooth.

C. Treads, floor plate castings, and landing shall be aluminum alloy AAF356F. Half treads shall be at least 9-inches wide and 10-inches deep. The central stringer shall be aluminum alloy 6063-T52, 1-3/4-inches x 4 inches x 1/8-inch box shape. Guards shall be aluminum alloy 6061-T4. Finish shall be Aluminum Association M12C22A41.

D. The alternating tread type stairs shall be Model 68AL, as manufactured by Lapeyre Stair, Harahan, Louisiana, or approved equal.

PART 3 – EXECUTION

3.01 FABRICATION

A. All measurements and dimensions shall be based on field conditions and shall be verified by the Contractor prior to fabrication. Such verification shall include coordination with all adjoining work.

B. All fabricated work shall be shop fitted together as much as practicable, and delivered to the field, complete and ready for erection. All miscellaneous items such as stiffeners, fillets, connections, brackets, and other details necessary for a complete installation shall be provided.

C. All work shall be fabricated and installed in a manner that will provide for expansion and contraction, prevent shearing of bolts, screws, and other fastenings, ensure rigidity, and provide a close fit of sections.

D. Finished members shall conform to the lines, angles, and curves shown on the drawings and shall be free from distortions of any kind.

E. All shearings shall be neat and accurate, with parts exposed to view neatly finished. Flame cutting is allowed only when performed utilizing a machine.

F. All shop connections shall be welded unless otherwise indicated on the Drawings or specified herein. Bolts and welds shall conform to Section 05 05 23 – Metal Fastening. All fastenings shall be concealed where practicable.

G. Fabricated items shall be shop painted when specified in accordance with Section 09 90 00 – Painting.

3.02 INSTALLATION

A. Assembly and installation of metal stairs shall be performed in strict accordance with manufacturer's recommendations.

B. All miscellaneous metalwork shall be erected square, plumb and true, accurately fitted, adequately anchored in place, and set at proper elevations and positions.

C. Metal stairs shall field painted when specified in accordance with Section 09 90 00 – Painting.

END OF SECTION

SECTION 05 52 00
GUARDS AND RAILINGS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Furnish all materials, labor, and equipment required to provide all metal guards and railings in accordance with the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 05 05 23 – Metal Fastening

B. Section 05 10 00 – Metal Materials

C. Section 09 90 00 – Painting

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. New York State Building Code

2. Aluminum Association Specifications for Aluminum Structures

3. Occupational Safety and Health Administration (OSHA) Regulations

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures.

1. Complete fabrication and erection drawings of all metal work specified herein, sealed by a Professional Engineer currently licensed in New York State.

2. Other submittals as required in accordance with Section 05 10 00 – Metal Materials and Section 05 05 23 – Metal Fastening.

3. Structural calculations on guard and handrail system sealed by a Professional Engineer currently licensed in New York State.

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PART 2 – PRODUCTS

2.01 METAL MATERIALS

A. Metal materials used for guards and railings shall conform to Section 05 10 00 – Metal Materials, unless noted otherwise.

2.02 METAL FASTENING

A. All welds and fasteners used in guards and railings shall conform to Section 05 05 23 – Metal Fastening, unless noted otherwise.

2.03 GUARDS AND RAILINGS

A. General – Design of guard and handrail systems is the exclusive responsibility of the Contractor. Guard systems shall consist of all railings, posts, toeboards, baseplates, anchors, and accessories required for a complete and rigid installation.

1. All guard systems shall be fabricated from extruded aluminum alloy 6061-T6 or 6105-T5, with Aluminum Association M12C22A41 finish, unless otherwise noted.

2. Metal railings shall be fabricated from 1-1/2 inch Schedule 40 minimum pipe. Metal railing support posts shall be fabricated from 1-1/2 inch Schedule 80 minimum pipe.

3. The top of the upper guard rail shall be 42 inches above the walking surface for level guards. For stair guards, the top of the upper guard rail shall be 42 inches above the leading edge of the tread nosing. The top of stair handrail shall be 34 inches above the leading edge of the tread nosing.

4. Posts

    a. Maximum horizontal spacing between posts for level rail shall be six feet.

    b. Maximum horizontal spacing between posts for stair rail shall be five feet.

5. All rail joints shall be finished flush and shall occur only at supports. Posts shall not interrupt the continuation of the top rail at any point along the railing, including corners and end terminations. The top surface of the top railing shall be smooth and shall not be interrupted by projecting fittings.

6. Toeboards

    a. Toeboards shall project 4-inches above the walking surface and shall not infringe on the minimum required walkway width.

    b. Aluminum toeboards shall be extruded from aluminum alloy 6063-T6 unless otherwise noted.

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c. Toeboards shall have a minimum thickness of 1/8" at any point. Geometry of toeboard shall closely resemble geometry shown on Drawings.

7. Expansion joint splices shall be provided at 30 foot maximum spacing and at all expansion joints in the structure supporting the guards.

8. The guard system shall be designed to resist the design loads specified by both OSHA and the New York State Building Code.

9. Provide handrail extensions at top and bottom of stairs and ramps in accordance with the New York State Building Code.

B. The Contractor shall have the option of providing a guard system of either an all welded type construction or a component type construction.

1. With both the all welded or component type construction, the baseplates and toeboards shall be furnished as shown on the Drawings.

2. Component Type System

a. All fittings and brackets shall be designed for stainless steel concealed set screws with internal tyne type connectors.

b. Exposed fittings shall be cast or extruded aluminum, or stainless steel to match guard material, except where corrosion-resistant steel is employed as a standard fabricator's item for use.

c. Component type guards shall be as manufactured by:

1) Thompson Fabricating Company, Inc.;

2) Hollaender Manufacturing Company, Inc.;

3) Or approved equal.

3. Welded guards may be field assembled using component type fittings as described herein.

C. Guards shall be either Type I or Type II guards as shown on the Drawings. If no type is indicated on Drawings, guards shall be Type I.

1. Type I guards shall be a two-rail system. The intermediate rail shall be located as required to prevent passage of a 21-inch diameter sphere at any point.

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2. Type II guards shall be a three-rail system with vertical posts spanning between the two intermediate rails.

    a. The centerline of the lower intermediate rail shall be 7 inches above the walking surface.

    b. The upper intermediate members, whether additional rails or vertical posts, shall be located below the top rail at a spacing as required to prevent passage of a 4-inch diameter sphere between the two rails.

    c. Vertical posts spanning between the intermediate rails shall be 1/2" diameter schedule 40 pipe or fiberglass rod.

    d. Spacing of vertical posts shall be as required to prevent passage of a 4-inch diameter sphere at any point.

D. Where gates are required in guards as shown on the Drawings, they shall be self-closing and shall be provided by the same manufacturer as the guards. Gates shall swing away from the opening being protected by the guards.

E. Where safety chains are required in guards as shown on the Drawings, chains shall be constructed of Type 304 stainless steel. Chains shall be straight link style, 3/16-inch diameter, with at least twelve links per foot, and with snap hooks on each end. Snap hooks shall be boat type and eye bolts for attachment of chains shall be 3/8-inch bolts with 3/4-inch eye diameter welded to the railing posts. Two (2) chains, four inches longer than the anchorage spacing shall be supplied for each guarded area.

2.04 FREE STANDING RAILING SYSTEM

A. Free standing railing system shall be installed on roof ledges where accessible equipment is provided on roof and roof does not have a perimeter parapet wall of a minimum height of 42 inches.

1. Free standing railing system shall be:

    a. Safety Rail 2000 Guardrail System by BlueWater Mfg., Inc;

    b. Or approved equal.

B. Toe Board brackets shall be used when the parapet wall is less than 3-1/2” in height.

C. Performance Characteristics: Shall meet and exceed OSHA (Standards - 29 CFR) 1926.502 (b).

1. Railing System shall be designed to withstand a minimum 200 pounds of test load in any direction.

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2. Railing System shall consist of a top rail and rail at mid height between top rail and walking surface.

3. Railing system shall extend to a height of at least 42" from the finished roof deck.

4. Railing system shall be free of sharp edges and snag points.

D. Railing and Base

1. Rail shall be 1 5/8” O.D. Hot Rolled Pickled Electric Weld Tubing

2. Each support post shall have a free standing base cast from Class 30 Gray Iron material.

3. Each base shall have four (4) receiver posts for accepting the rails.

4. The receiver posts shall have a positive locking system. A friction locking system will not be acceptable.

5. The receiver posts shall have a slot to enable the rails to be mounted in any direction.

E. Hardware

1. The securing pins shall be made from 1010 carbon steel. The pins shall be zinc plated and yellow chromate dipped. The pins shall consist of a collared pin and a lanyard that connects to a lynch pin.

2. For Gate Assemblies Only. Bolts and washers shall be 3/8" x 3 ½" and 3/8" x 3" grade 5, zinc plated.

3. Finish

a. Rails: Specify factory finish Safety Yellow Powder Coat Paint, Hot Dipped Galvanized or a color to match the building.

b. Bases: Specify factory finish Safety Yellow Powder Coat Paint, Hot Dipped Galvanized or a color to match the building.

PART 3 – EXECUTION

3.01 FABRICATION

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A. All measurements and dimensions shall be based on field conditions and shall be verified by the Contractor prior to fabrication. Such verification shall include coordination with all adjoining work.

B. All fabricated work shall be shop fitted together as much as practical, and delivered to the field, complete and ready for erection.

C. All work shall be fabricated and installed in a manner that will provide for expansion and contraction, prevent shearing of bolts, screws, and other fastenings, ensure rigidity, and provide a close fit of sections.

D. Finished members shall conform to the lines, angles, and curves shown on the drawings and shall be free from distortions of any kind.

E. All shearings shall be neat and accurate, with parts exposed to view neatly finished. Flame cutting is allowed only when performed utilizing a machine.

F. Concrete anchors and bolts for attachment of guard baseplates to supporting members shall conform to Section 05 05 23 – Metal Fastening.

G. All fabricated items shall be shop painted in accordance with Section 09 90 00 – Painting.

3.02 INSTALLATION

A. Assembly and installation of guards and railings shall be performed in strict accordance with manufacturer's recommendations.

B. All guards and railings shall be erected square, plumb and true, accurately fitted, adequately anchored in place, and set at proper elevations and positions.

END OF SECTION

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SECTION 05 53 00

GRATINGS, CHECKERED FLOOR PLATES, AND ACCESS DOORS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Furnish all materials, labor, and equipment required to provide all gratings, floor plates, and access doors in accordance with the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 05 05 13 – Galvanizing

B. Section 05 05 23 – Metal Fastening

C. Section 05 10 00 – Metal Materials

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. New York State Building Code

2. Aluminum Association Specifications for Aluminum Structures

3. Occupational Safety and Health Administration (OSHA) Regulations

4. ANSI/NAAMM MBG 531 – NAAMM Metal Bar Grating Manual

5. ASTM C1802 – Design, Testing, Manufacture, Selection, and Installation of Fabricated Metal Access Hatches for Utility, Water, and Wastewater Structures

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures.

1. Complete fabrication and erection Drawings of all gratings, floor plates, and access doors specified herein.

2. For checkered floor plates, structural calculations signed and sealed by a currently registered Professional Engineer in New York State verifying the proposed floor plate meets the minimum load and deflection requirements stipulated herein.

3. For access doors provided by a manufacturer not specifically named herein, structural calculations signed and sealed by a Professional Engineer currently

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registered in New York State verifying the proposed access door meets the minimum load and deflection requirements stipulated herein. For access doors provided by a named manufacturer, sealed calculations are not required provided the applicable ASTM C1802 load rating is clearly indicated in the submittal for each proposed product.

4. Other submittals as required in accordance with Section 05 10 00 – Metal Materials and Section 05 05 23 – Metal Fastening.

PART 2 – PRODUCTS

2.01 METAL MATERIALS

A. Metal materials used for gratings, floor plates, and access doors shall conform to Section 05 10 00 – Metal Materials, unless noted otherwise.

2.02 METAL FASTENING

A. All welds and fasteners used for gratings, floor plates, and access doors shall conform to Section 05 05 23 – Metal Fastening, unless noted otherwise.

2.03 GRATING

A. General - Grating, including support frames, fastenings, and all necessary appurtenances for a complete installation, shall be furnished as indicated on the Drawings.

1. All exposed bearing ends of grating shall be enclosed in a perimeter band of the same dimensions and material as the main bars, including ends at all cutouts.

2. Grating shall be fabricated into easily removable sections and shall be fastened at each corner and as required with fasteners provided by the grating manufacturer. No fasteners shall be permitted to project above the walking surface.

3. Grating shall be designed for a loading of 150 psf unless otherwise required by the Drawings. Grating deflection shall not exceed 1/4 inch under a uniform load of 150 psf. Minimum grating depth shall be 1-1/2 inches, unless structural requirements based on clear span require more depth.

4. Grating installed in cast-in-place concrete shall be provided with embedded support frames on all perimeter and bearing edges. Support frames shall be extruded frames with continuous means of anchoring frames to concrete around entire perimeter of frame. Support frames shall be fabricated from the same material as the grating.

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B. Aluminum Grating

1. Aluminum grating shall be of I-bar type and shall consist of extruded bearing bars positioned and locked by crossbars. All supports, cross members, etc. shall be aluminum. Plank clips for grating attachment to frames and any other required attachments, shall be aluminum or stainless steel. Bolts shall be stainless steel. Provide embedded aluminum support frames for cast-in-place concrete installations.

2. Grating shall be:

   a. “IB” by Harsco Industrial IKG;

   b. “I-Bar 19SGI4", by Ohio Grating Inc.;

   c. “I-Bar” by Thompson Fabricating LLC;

   d. Or approved equal.

C. Aluminum Plank Grating

1. Aluminum plank grating shall be unpunched planks of extruded aluminum welded together to form panels. Panel ends shall have an extruded aluminum end bar welded in place. Two stainless steel recessed lifting handles shall be provided for individual panels, one handle at each end, where specifically shown on drawings. All support members shall be aluminum. Plank clips for grating attachment to frames and any other required attachments, shall be aluminum or stainless steel. Bolts shall be stainless steel. Provide embedded aluminum support frames for cast-in-place concrete installations.

2. Aluminum plank grating shall be:

   a. HD-P by Harsco Industrial IKG.;

   b. Heavy Duty Series by Ohio Gratings, Inc.;

   c. Unpunched Duo-Grip Extruded Series by Alabama Metal Industries Corporation (AMICO);

   d. Or approved equal.

D. Heavy Duty Steel Grating

1. Heavy duty steel grating shall be galvanized according to Section 05 05 13 – Galvanizing.

2. Main bearing bars shall conform to ASTM A36. Cross bars shall be flush with the top of the grating. Provide embedded galvanized steel support frames for cast-in-place concrete installations.

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3. Grating span shall be 36 inches maximum and shall satisfy AASHTO loading for HS-20 truck.

4. Grating shall be manufactured by:

   a. Harsco Industrial IKG;

   b. Ohio Gratings, Inc.

   c. Or approved equal.

2.04 CHECKERED FLOOR PLATES

A. Floor plates shall meet the requirements of ASTM C1802 for Load Level 1 – Light Pedestrian Load, minimum, unless otherwise indicated on the Drawings.

B. Floor plates shall be aluminum unless noted otherwise.

C. All floor plates shall be checkered plate with an approved raised pattern, non-skid surface.

D. Openings greater than 42 inches in either direction shall require two plates opening via hinges in opposite directions.

E. Floor plates shall be designed to carry a minimum service level live load of 150 psf, or a concentrated load of 300 pounds applied over a 5.50 inch by 5.50 inch area, whichever produces the greatest stress, unless indicated otherwise on the Drawings. Loading shall be positioned to produce the greatest stresses, both due to maximum moment and maximum shear load conditions.

F. All components of checkered floor plates shall have a minimum tensile yield strength of 23,000 psi and a minimum compressive yield strength of 21,000 psi. Yield strengths shall be indicated on both the structural calculations and the fabrication drawings.

G. Live load deflection shall be limited to L/200 of the span, but no greater than 3/16 inch.

H. All checkered floor plates shall be fabricated from 1/4" plate, minimum and shall be stiffened as required to maintain allowable stress and deflection requirements specified herein.

I. Stiffeners shall consist of angles or bars welded to the bottom of the plate.

J. Checkered floor plate hinges shall be either stainless steel or aluminum with stainless steel pins and fasteners.

K. All checkered floor plates shall be provided with recessed handles. Handle material shall be as shown on the Contract Drawings.

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L. Air-tight and water-tight checkered floor plates shall be provided with a 1/8-inch-thick neoprene gasket between the checkered plate and the support frame. Gasket material shall be bonded to the support frame and checkered floor plates shall be bolted to the structural support frame with countersunk stainless-steel flathead screws.

M. All floor plates shall be clearly marked with the information listed below. Markings shall be indicated on metal or plastic tags permanently attached to the floor plate or frame or shall be permanently painted or printed.

1. The manufacturer's name or trademark, location, and telephone contact number.

2. The manufacturer's model number and ASTM designation.

3. The design load level as indicated in ASTM C1802. If the design requires deviation from the Load Level requirements specified in ASTM C1802, a description of the modifications shall be included.

4. Date of manufacture and/or serial number.

2.05 ACCESS DOORS

A. General

1. Door opening sizes, number, and direction of swing of door leaves, and locations shall be as shown on the Drawings. The Drawings shall indicate the dimensions of the openings in the concrete. Clear opening dimensions shall be no smaller than six inches less than the concrete opening.

2. All doors shall be aluminum unless otherwise noted.

3. All door components shall have a minimum tensile yield strength of 23,000 psi and a minimum compressive yield strength of 21,000 psi. Yield strengths shall be indicated on both the structural calculations and the fabrication drawings.

4. Openings larger than 42 inches in either direction shall have double leaf doors.

5. Doors shall be designed for flush mounting and for easy opening from both inside and outside.

6. All doors shall be provided with an automatic hold-open arm with release handle.

7. Double leaf doors shall be provided with safety bars to go across the open sides of the door, when in the open position. Brackets shall be provided on the underside of the doors to hold the safety bars when not in use.

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8. All hardware, including but not limited to, all parts of the latch and lifting mechanism assemblies, hold open arms and guides, brackets, hinges, springs, pins, and fasteners shall be stainless steel.

9. All doors specifically required to be watertight shall be installed with a continuous gasket.

10. Access door frames with integral gutter systems shall be equipped with a 1-1/2-inch minimum drainpipe located by the manufacturer. The drainpipe shall be provided by the Contractor and shall extend to the nearest point of discharge acceptable to the Engineer.

11. All doors shall be clearly marked with the information listed below. Markings shall be indicated on metal or plastic tags permanently attached to the door or frame or shall be permanently painted or printed.

    a. The manufacturer's name or trademark, location, and telephone contact number.

    b. The manufacturer's model number and ASTM designation.

    c. The design load level as indicated in ASTM C1802. If the design requires deviation from the Load Level requirements specified in ASTM C1802, a description of the modifications shall be included.

    d. The nominal door opening dimensions and/or the manufacturer's model number.

    e. Date of manufacture and/or serial number.

B. Floor, Wet Well and Dry Pit Access Doors

1. Door leaves shall be 1/4 inch, minimum, diamond pattern plate with an approved raised pattern, non-skid surface. Plate shall be stiffened as required to maintain allowable stress and deflection requirements. Stiffeners shall consist of angles or bars welded to the bottom of plate.

2. Doors shall be designed for flush mounting and for easy opening from both inside and outside.

3. All doors shall have an enclosed compression spring assist and open to 90 degrees.

4. Doors not required to support traffic loading shall meet the requirements of ASTM C1802 for Load Level 2 – Pedestrian Load as a minimum and the following:

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a. Doors shall be designed to carry a minimum service level live load of 300 psf or a concentrated load of 600 pounds applied over a 5.50 inch by 5.50 inch area, whichever produces the greatest stress, unless indicated otherwise on the Drawings. Loading shall be positioned to produce the maximum stresses, both due to maximum moment and maximum shear load conditions.

b. Live load deflection shall be limited to L/200 of the span, but not greater than 3/16 inch.

c. Unless otherwise noted, exterior doors shall have an integral gutter system and be:

1) Type “FDDP” by Nystrom;

2) Type ”W1S” or “W2S” by Halliday Products Inc.;

3) Type "TPS" or "TPD", by U.S.F. Fabrication Inc.;

4) Type "THG" or "THG-D", by Thompson Fabricating LLC;

5) Type “J-AL” or “JD_AL” by the Bilco Company;

6) Or approved equal.

d. Unless otherwise noted, interior doors shall be:

1) Type "FDNP” by Nystrom;

2) Type ”S1S” or “S2S” by Halliday Products Inc.;

3) Type "APS300" or "APD300", by U.S.F. Fabrication Inc.;

4) Type "TH" or "TH-D" by Thompson Fabricating LLC.

5) Or approved equal.

5. Doors required to support traffic loadings shall meet the requirements of ASTM C1802 for Load Level 4 – Occasional Truck Traffic, unless otherwise indicated on the Drawings.

a. For openings less than or equal to 48 inches, the design loading shall consist of a service level 16,000 pound load applied over a 10 inch by 20 inch area with traffic both parallel and perpendicular to the span considered. Loadings shall be positioned to produce the maximum stresses, both due to maximum moment and maximum shear load conditions.

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b. For openings greater than 48 inches, two load cases shall be considered. Load Case 1 shall consist of two service level 16,000 pound loads spaced at 48 inches on center with each load applied over a 10 inch by 20 inch area and assuming the traffic direction is perpendicular to the span of the door. Load Case 2 shall consist of two service level 12,500 pound loads spaced at 48 inches on center with each load applied over a 10 inch by 20 inch area and assuming the traffic direction is parallel to the span of the door. Loadings for both cases shall be positioned to produce the maximum stresses, both due to maximum moment and maximum shear load conditions.

c. Live load deflections shall be limited to L/250 of the span, but not greater than 3/16 inch, and shall be determined based off a service level 16,000 pound load.

d. Unless otherwise noted, doors rated for HS-20 traffic loading shall have an integral gutter system and be:

1) Type “FDDH” by Nystrom;

2) Type “H1C” or “H2C” by Halliday Products, Inc.;

3) Type “THS” or “THD” by U.S.F. Fabrication Inc.;

4) Type “THG-H20” by Thompson Fabricating LLC;

5) “Type JAL-H20” or “JDAL-H20” by the Bilco Company;

6) Or approved equal.

C. Roof Access Doors

1. Doors shall be designed for 40 psf live load unless noted otherwise.

2. Doors for service stairs shall be Bilco Type L roof Scuttles or approved equal.

3. Doors for ladder access shall be Bilco Type S or SS Roof Scuttle or approved equal.

2.06 FALL THROUGH PREVENTION SYSTEM

A. All checkered floor plates and access doors covering openings measuring 12 inches or more in its least dimension through which persons may fall shall be equipped with a fall through prevention system, except as noted on the Contract Drawings. Checkered floor plates and access doors shall be provided with a permanent installed fall through prevention grate system that provides continuous safety assurance in both its closed

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and open positions. The grate system shall be made with 6061-T6 aluminum or FRP and be designed for a 300 psf minimum live load, unless noted otherwise.

PART 3 – EXECUTION

3.01 FABRICATION

A. All measurements and dimensions shall be based on field conditions and shall be verified by the Contractor prior to fabrication. Such verification shall include coordination with adjoining work.

B. All fabricated work shall be shop fitted together as much as practicable, and delivered to the field, complete and ready for erection. All miscellaneous items such as stiffeners, fillets, connections, brackets, and other details necessary for a complete installation shall be provided.

C. All work shall be fabricated and installed in a manner that will provide for expansion and contraction, prevent shearing of bolts, screws, and other fastenings, ensure rigidity, and provide a close fit of sections.

D. Finished members shall conform to the lines, angles, and curves shown on the Drawings and shall be free from distortions of any kind.

E. All shearings shall be neat and accurate, with parts exposed to view neatly finished. Flame cutting is allowed only when performed utilizing a machine.

F. All shop connections shall be welded unless otherwise indicated on the Drawings or specified herein. Bolts and welds shall conform to Section 05 05 23 – Metal Fastening. All fastenings shall be concealed where practicable.

3.02 INSTALLATION

A. Assembly and installation of fabricated system components shall be performed in strict accordance with manufacturer's recommendations.

B. All gratings, checkered floor plates, and access doors shall be erected square, plumb and true, accurately fitted, adequately anchored in place, and set at proper elevations and positions. Embedded support frames shall be set level and square.

C. Where access doors utilize leveling bolts, or are placed on irregular surfaces, and are not to be embedded in concrete, the area beneath the frames shall be fully grouted with non-shrink grout to create a uniformly loaded bearing surface.

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D. Grating shall not be field cut or modified unless approved by Engineer.

E. Grating shall not be used for equipment support or anchorage.

END OF SECTION

SECTION 05 55 00
STAIR TREADS AND NOSINGS

PART 1 – GENERAL

1.01 REQUIREMENT

A. Furnish all materials, labor, and equipment required to provide all stair treads and nosings in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 05 05 23 – Metal Fastening

B. Section 05 10 00 – Metal Materials

C. Section 05 51 00 – Metal Stairs

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. New York State Building Code

2. Aluminum Association Specifications for Aluminum Structures.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures.

1. Complete fabrication and erection drawings of all work specified herein.

2. Other submittals as required in accordance with Section 05 10 00 – Metal Materials and Section 05 05 23 – Metal Fastening.

PART 2 – PRODUCTS

2.01 METAL MATERIALS

A. Metal materials used for stair treads and nosings shall conform to Section 05 10 00 – Metal Materials, unless noted otherwise.

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2.02 METAL FASTENING

A. All welds and fasteners used for stair treads and nosings shall conform to Section 05 05 23 – Metal Fastening, unless noted otherwise.

2.03 SAFETY STAIR NOSINGS

A. Abrasive cast aluminum, safety stair nosings shall be provided on all concrete or concrete filled steel pan stairs, including the top stair of metal stairs that attach to concrete, and as shown on the Drawings unless noted otherwise.

B. Nosing shall be 3 inches wide and shall extend the full width of the stairway minus 3 inches on either side. Nosing shall be cast into the concrete and held in place with butterfly type extruded anchors.

C. The nosing shall be:

1. "Style 231-A", by Amstep Products;

2. “Alumogrit Type 101" by Wooster Products, Inc.;

3. "Type AX", by Safe-T-Metal Company;

4. Or approved equal.

D. For steel pan concrete filled stairs, nosing shall be:

1. "Type 101-SP" Wooster Products, Inc.;

2. "Type AXPE" by Safe-T-Metal Company;

3. Or approved equal.

E. For pan stairs, nosing shall be continuous over corner of stair treads to fully protect corner of treads from abrasion. All exposed fasteners shall be Type 304 stainless steel.

2.04 STAIR TREADS

A. Stair treads shall be aluminum with an abrasive nosing as shown on the Drawings.

B. Stair treads shall be designed for the live load specified in Section 05 51 00 – Metal Stairs.

C. Stair treads shall be as manufactured by:

1. IKG Industries;

2. Ohio Gratings, Inc.;

3. Safe-T-Metal Company;

4. Or approved equal.

PART 3 – EXECUTION

3.01 FABRICATION

A. All measurements and dimensions shall be based on field conditions and shall be verified by the Contractor prior to fabrication. Such verification shall include coordination with adjoining work.

B. All fabricated work shall be shop fitted together as much as practicable, and delivered to the field, complete and ready for erection. All miscellaneous items such as stiffeners, connections, brackets, and other details necessary for a complete installation shall be provided.

C. All work shall be fabricated and installed in a manner that will provide for expansion and contraction, prevent shearing of bolts, screws, and other fastenings, ensure rigidity, and provide a close fit of sections.

D. All shearings shall be neat and accurate, with parts exposed to view neatly finished. Flame cutting is allowed only when performed utilizing a machine.

E. All shop connections shall be welded unless otherwise indicated on the Drawings or specified herein. Bolts and welds shall conform to Section 05 05 23 – Metal Fastening. All fastenings shall be concealed where practicable.

3.02 INSTALLATION

A. Assembly and installation of stair treads and nosings shall be performed in strict accordance with manufacturer's recommendations.

B. All stair treads and nosings shall be erected square, plumb and true, accurately fitted, adequately anchored in place, and set at proper elevations and positions.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Furnish labor, materials, equipment, and appliances required for complete execution of Work shown on the Drawings and specified herein.

B. Principal items of work include:

1. Wood blocking, nailers, grounds, furring, ties, centering, etc., necessary or required for attachment or support of work under this Section and other Sections.

2. Fasteners, including nails, screws, bolts, anchors, and other fastenings, required to secure work under this Section.

3. Temporary enclosures and protective boarding.

4. Wood preservative treatment for all wood members in contact with roofing, masonry, concrete, and exposed to the elements.

1.02 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of this Section, Work shall conform to the applicable requirements of the following:

1. American Wood Protection Association (AWPA) Standards, including, but not limited to:

a. AWPA-CA – Preservative Standards, Lumber and Plywood

b. AWPA-C20 – Structural Lumber Fire-Retardant Treatment by Pressure Process

c. AWPC-C27 – Plywood Fire-Retardant Treatment by Pressure Process

d. AWPA-M4 – Standards for Care of Preservative Treated Wood Products

2. American Plywood Association (APA) – Guide to Plywood Grades

3. FM 1-49 – Perimeter Flashing

4. Underwriters Laboratories

1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in Section 01 33 00 – Submittal Procedures, submit the following:

1. Certifications of Preservative and Fire-Retardant Treatment.

2. Warranty of treatment manufacturer.

3. Certification of type and grade of lumber to be used.

4. Certification of type, rating, and conformance to APA Standards.

1.04 DELIVERY AND STORAGE

A. Take all measures necessary to protect products against damage during delivery and storage.

B. Store lumber in enclosed places in such a manner to provide ventilation and protection from the weather.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Blocking, nailers, grounds and the like: Eastern Spruce or Douglas Fir - No. 3 Dimension Lumber or Construction Grade, with a moisture content not to exceed 19%.

B. Plates, blocking, and nailers in contact with concrete or masonry: Pressure treated southern yellow pine.

C. Plywood: Identified with APA Grade trademarks of the American Plywood Association, in thickness as shown on the Drawings.

1. Exterior: AC-EXT-APA where exposed to view or a finish is required, CD-EXT-APA where concealed.

2. Interior: AC-INT-APA where exposed to view or a finish is required, CD-INT-APA where concealed.

D. Structural Framing Lumber: Douglas Fir No.1 grade with fb = 1,500 pounds per square inch and E = 1,700,000 pounds per square inch, 19 percent moisture content.

E. Fasteners: Provide clamps, connectors, straps, nails, bolts, screws, anchors, ties and other accessories and fasteners shown or required to properly secure all rough carpentry. Fasteners and accessories shall be stainless steel, galvanized, or other

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noncorrosive metal recommended for use. Fasteners used with pressure treated wood shall be compatible with the wood preservative treatment to prevent corrosion of fasteners.

F. Wood Preservative Treatment: Waterborne pressure treatment in conformance with the American Wood Protection Association’s standard P5. Retention shall be in accordance with AWPA Standards and be a minimum of 0.40 pounds per cubic foot for contact with or below ground, concrete, or masonry and 0.25 pounds per cubic foot for above ground. Stamp each piece of treated wood with a trademark identifying the classification of the treatment or a certificate from the processor for each shipment.

G. Fire Retardant Treatment: Fire-retardant lumber and plywood must have an Underwriters Laboratories (UL) stamp signifying a FR-S rating and certifying a 25 or less flame spread and smoke developed value, when tested in accordance to UL 723, ASTM E 84, and NFPA 255 "Tunnel Test", and when the test is extended for 20 additional minutes. Treatment formulation shall contain no halogens, sulfates, chlorides, or ammonium phosphate. Smoke toxicity shall be no more than that of untreated wood.

PART 3 – EXECUTION

3.01 COORDINATION

A. Coordinate with all trades as to nailers, blocking, grounds and the like required for the attachment of their work and other items requiring same. Carry out all work as required to coordinate work of other trades.

3.02 INSTALLATION

A. Perform work in conformance manufacturer's recommendations and specifications, industry, national and local standards, and codes.

B. Layout, cut, fit, and erect rough blocking, nailers, furring and other rough carpentry. Do cutting work in connection with carpentry and finish for other trades. Brace plumb and level all members in true alignment and rigidly secure in place with sufficient nails, spikes, screws, and bolts. Defects which render any piece or part unable to serve its intended purpose shall be discarded or cut out and replaced.

C. Provide all bracing, supports and shoring required to support construction.

D. Protect all masonry including edges of concrete platforms and similar items. Remove protective covering when directed. Take special precautions at masonry openings and corners of the building.

E. Set all rough hardware, such as plates, spikes, bolts, nails, lag screws, lagging bolts, anchors, etc., as required to hold woodwork together or to anchor or secure it to other materials and construction.

F. Provide wood grounds, nailing strips and similar items wherever necessary or required throughout the project for the support, proper erection or installation of the work and support of mirrors, cabinets, shelf cleats, base and similar items. Thoroughly secure in place by approved means.

G. Secure wood grounds, nailing strips and similar items to metal plugs set in masonry, toggle or expansion bolts. Give the mason all necessary information to enable him to lay out correctly the location for metal wall plugs. Wood plugs will not be accepted.

H. Construct joints to support dead loads, live loads, snow loads, wind loads, or combinations in conformance with "National Design Specifications for Stress Grade Lumber and its Fastenings", recommended by National Forest Products Association.

I. Nailers and Blocking: Provide and secure wood nailers, blocking, for the reception of roof curbs, roofing, etc. in accordance with FM I-49, or as required by the Building Code, whichever is most stringent. Coordinate attachment with roofing system, where roofing system design includes design of nailers provide attachment in accordance with engineered roofing design.

1. Provide nailers of sizes, shapes and profiles indicated on the Drawings. Nailers shall not be less than 2 x 6. Build up nailers as required to achieve thickness of insulation or as required to provide proper attachment of roofing and curbs. Provide anchors as required for secure attachment of roofing systems, copings, gravel stops or other edge terminations.

3.03 TEMPORARY PROTECTION

A. Provide and install all temporary protection in accordance with applicable provisions of the Contract Documents, OSHA regulations, and as follows:

1. Temporary protection shall include wood doors, railings, protection of floor or roof openings, temporary partitions, and the like; adequately maintained in good repair during the life of the Contract.

2. Furnish and set temporary partitions with wood doors at all exterior doorways, exterior openings or in locations exposed to weather. Substantially build and hang, with proper hinges, locks, and other necessary hardware, and remove and reset whenever required to accommodate the Work and keep in good repair.

3. Provide substantial temporary wood covering or guards for openings left in floor or roof slabs for ducts, shafts, etc., using rough planking at least 2 inch thick, cleated together and otherwise made sufficiently strong and put in place wherever required immediately after the forms have been removed.

3.04 JOB CONDITIONS

A. If the installation of metal frames and glass does not promptly follow the completion of the exterior enclosures, and if the absence of enclosures would cause damage, close in all such openings temporarily by the use of heavy polyethylene plastic sheeting, or canvas stretched over and nailed to frames of 1 inch x 2 inch or heavier strips.

3.05 REMOVAL OF TEMPORARY WORK

A. Remove all temporary protection when so directed, or prior to acceptance of this project.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 07 21 00

THERMAL INSULATION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This Section describes the specific requirements for perimeter foundation insulation, cavity wall insulation, curtainwall insulation, thermal batt insulation, formaldehyde-free sound attentuation batt insulation, fire safing insulation with gas and smoke tight fire-resistant sealants and other fire stop system components for each kind and condition of penetration through fire-rated construction and miscellaneous materials and accessories as specified herein and as required to complete the Work. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all building insulation Work.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03 30 00 – Cast-in-Place Concrete

B. Section 04 22 23.23 – Prefaced Concrete Unit Masonry

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. NYSBC – New York State Building Code and New York State Energy Conservation Code

B. ASTM C165 – Measuring Compressive Properties of Thermal Insulations

C. ASTM C177 – Steady-State Heat Flux Measurement and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus, Standard Test Method for

D. ASTM C203 – Breaking Load and Flexural Properties of Block-Type Thermal Insulation, Standard Test Methods for

E. ASTM C236 – Steady-State Thermal Performance of Building Assemblies by Means of aGuarded Hot Box, Test Method for

F. ASTM C272 – Water Absorption of Core Materials for Structural Sandwich Constructions, Test Method for

G. ASTM C303 – Dimensions and Density of Preformed Block-Type Thermal Insulation, Test Method for

H. ASTM C356 – Linear Shrinkage of Preformed High-Temperature Thermal Insulation Subjected to Soaking Heat

I. ASTM C518 – Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of Heat Flow Meter Apparatus, Test Method for

J. ASTM C531 – Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Monolithic Surfacings, and Polymer Concrete, Test Method for

K. ASTM C578 – Rigid, Cellular Polystyrene Thermal Insulation, Specification for

L. ASTM C612 – Mineral Fiber Block and Board Thermal Insulation

M. ASTM C665 – Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing

N. ASTM C726 – Insulation Board, Thermal (Mineral Fiber)

O. ASTM C795 – Thermal Insulation for Use in Contact with Austenitic Stainless Steel

P. ASTM C1104/C1104M – Determining the Water Vapor Absorption of Unfaced Mineral Fiber Insulation

Q. ASTM C1338 – Determining Fungi Resistance of Insulation Materials and Facings

R. ASTM D696 – Coefficient of Linear Thermal Expansion of Plastics between -30 Degrees C and 30 Degrees C, Test Method for

S. ASTM D1621 – Compressive Properties of Rigid Cellular Plastics, Test Method for

T. ASTM E84 – Surface Burning Characteristics of Building Materials, Test Method for

U. ASTM E96/E96M – Water Vapor Transmission of Materials, Test Method for

V. ASTM E119 – Fire Tests of Building Construction and Materials, Test Methods for

W. ASTM E136 – Behavior of Materials in a Vertical Tube Furnace at 750 degrees C

X. ASTM E814 – Fire Tests of Penetration Firestop Systems

Y. UL 1479 – Fire Tests of Through-Penetration Firestops.

1.04 QUALITY ASSURANCE

A. Manufacturer/Installer Qualifications:

1. Engage single installers for each type of building insulation who are skilled, trained and have a record of successful experience in the application of each product and who have a record of performing Work in accordance with the recommendations

and requirements of the manufacturer or who can submit evidence in writing of being acceptable to the manufacturer for production of guaranteed construction and who agrees to employ only tradesmen with specific skill and successful experience in each type of Work. Submit names and qualifications to Engineer along with the following information on a minimum of three successful projects:

a. Names and telephone numbers of owners, architects or engineers responsible for projects.

b. Approximate contract cost of the building insulation system installed.

c. Amount of area installed.

B. Source Quality Control:

1. Obtain building insulations, requiring a hydrochlorofluorocarbon blowing agent, from manufacturers who manufacture specified insulation using a blowing agent acceptable for use until the year 2020 complying with the requirements of the Copenhagen Amendments to the Montreal Protocol in all ways.

2. Provide a manufacturer who will provide complete technical services including preparation and review of Working Drawings, installation methods and proposed detailing for the Work.

C. Performance Criteria:

1. Thermal Conductivity: The thicknesses shown are for the thermal conductivity, k-value at 75 degrees F, specified for each material.

2. Provide adjusted thicknesses as directed by Engineer for the use of material having a different thermal conductivity.

3. All material provided under this Section shall comply with the Specifications.

4. Comply with all applicable requirements of governing authorities and codes for all Work.

D. Pre-installation Conference:

1. Prior to the installation of the insulation and associated Work, Contractor shall schedule and meet at the site with the installer of the insulation, siding installer, curtain wall installer, and the installer of each component of associated work, Engineer and other representatives directly concerned with performance of the Work. Review foreseeable methods and procedures related to the insulation Work, including but not necessarily limited to, the following:

a. Review project requirements, including Drawings, Specifications and other Contract Documents.

b. Review required submittals, both completed and yet to be completed.

c. Review status of substrates including curing of foamed-in-place insulation, structural loading limitations and similar considerations.

d. Review availability of materials, tradesmen, equipment and facilities needed to make progress and avoid delays.

e. Review required inspection, testing, certifying and accounting procedures.

f. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.

g. Review regulations concerning environmental protection, health, safety, fire and similar considerations.

2. Reconvene the meeting at the earliest opportunity if additional information must be developed in order to conclude the subjects under consideration.

3. Record any revisions or changes agreed upon, reasons therefore, and parties agreeing or disagreeing with them.

1.05 SUBMITTALS

A. The Contractor shall submit the following in accordance with Section 01 33 00 Submittal Procedure:

B. Samples: Submit for approval the following:

1. 12-inch by 12-inch sample of each insulation product and each accessory and miscellaneous material to be used in the Work.

2. Samples will be reviewed by Engineer for general appearance and as examples of the types of components to be installed on the job mock-ups specified in other Sections. Compliance with other requirements is the responsibility of Contractor.

C. Working Drawings: Submit for approval the following:

1. Copies of specifications, installation instructions and general recommendations from the building insulation manufacturers, for each type of building insulation product. Include manufacturer's data substantiating that the materials comply with the requirements.

D. Test Reports: Submit for approval the following:

1. Copies of test reports verifying compliance with physical properties and environmental features specified herein.

2. Copies of testing agencies background and experience in performing similar tests to those specified.

E. Certificates: Submit for approval copies of certificates stating that the manufacturer of the foam-type rigid board insulation has used an environmentally safe blowing agent complying with the requirements of the Specifications.

1.06 DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:

1. Deliver building insulation products in manufacturer’s original, unopened, factory-sealed containers, bearing manufacturer’s name and labels, accurately representing container contents as approved by Engineer at time of Working Drawing submission.

2. Damaged materials unsuitable for use shall be rejected by Engineer and permanently removed from site by Contractor.

3. Do not deliver insulation materials to the project site before the time of installation.

4. Deliver materials in sufficient quantities to allow uninterrupted continuity of the Work.

B. Storage of Materials:

1. Store materials in original, undamaged containers with manufacturer's labels and seals intact.

2. Store all materials in a dry, enclosed area, off the ground and away from all possible contact with water, ice or snow.

3. Prevent damage to materials during storage primarily by minimizing the amount of time they are stored at the job-site before being incorporated into construction systems.

C. Handling of Materials:

1. Handle materials carefully in order to avoid damage and breakage or compressing of boards to less than their specified thickness or other damage.

2. Do not open containers, or expose materials to detrimental conditions or physical damage. Materials which are so exposed shall be removed from the Site and shall not be incorporated into the Work.

3. Handle materials in a manner which prevents inclusion of foreign materials.

4. Do not open packages or containers until all necessary preparatory Work is complete and installation will begin immediately. Do not allow materials to become wet or soiled or covered with ice or snow.

1.07 JOB CONDITIONS

A. Environmental Conditions:

1. Do not install building insulation when weather conditions are such that conditions do not comply with the building insulations manufacturer's written recommendations. Install building insulations only when damaging environmental condition are not forecasted for the time when the system material components will be exposed to potential damage.

2. Protect Work from precipitation, frost and direct sun.

3. Record decisions, conditions and agreements to proceed with the Work when weather conditions might be unfavorable. State the reasons for proceeding, with the names of the persons involved along with the changes, if any, or revisions, requirements or terms of the Contract.

4. Proceed with the Work only when temperature and moisture conditions comply with the manufacturer's written recommendations.

B. Protection:

1. Do not overload the building structure or damage in-place construction system with the weight of stored materials or use of equipment.

2. Provide continuous protection of materials against damage, wetting and moisture absorption primarily by storing materials under cover and above ground and away from all other construction traffic.

3. Protect materials against damage by construction activities.

C. Scheduling:

1. Proceed with the building insulation and associated Work only after curbs, blocking, substrate board, nailer strips, vents, drains and other projections through

the substrates have been installed, and when the substrate construction and framing of openings is complete.

2. Proceed with and complete the Work only when materials, equipment and tradesmen required for the installation of the building insulation and backfilling operations are at the site and are ready to follow with the Work in a manner which will not leave the Work vulnerable to damage or deterioration.

3. Do not advance the installation of building insulation materials beyond that which is necessary for proper sequencing of the Work and for which there is proper and secure protection from damaging weather and construction activities.

4. Do not begin preformed metal siding until testing confirms that all cavity spaces between the structure and substrate sheathing have been completely and uniformly filled with insulation. Do not delay job progress or permit substrate sheathing to degrade with exposure to detrimental weather conditions. Schedule installation of preformed metal siding immediately after testing indicates that all cavities have been filled or after remedial insulation Work has been completed. No final payment shall be made until testing confirms acceptability of the insulation installation and acceptability of the substrate sheathing by the preformed metal siding manufacturer.

D. Substitutions:

1. Do not change products, system components, manufacturers after Working Drawing approval by Engineer.

2. Clearly identify, in a manner which is highlighted to Engineer, all proposed substitutions, modifications, variations, unspecified features and "or equal" products. Provide complete comparative data with specified products at time of Working Drawing submission.

PART 2 – PRODUCTS

2.01 MATERIALS AND MANUFACTURERS

A. Perimeter Foundation Insulations:

1. Rigid, closed-cell, thermally stabilized, extruded, hydrogenated chlorofluorocarbon blown, lightweight foam board insulation with vertical channels fabricated into one side, with shiplap edges designed specifically for use on exterior foundation walls consisting of 100 percent virgin extruded polystyrene modified resin complying with ASTM C578, Type V.

2. Provide a blowing agent with lowest available ozone depletion potential, such as HCFC-142b, or better. HCFC-141b shall not be approved by Engineer.

3. Physical Properties: Provide the following:

   a. R-5 Thermal Resistance per inch, in accordance with ASTM C518 @ 75°F mean temp., ft2•h•°F/Btu, R-value, min.

   b. Compressive Strength (psi at 5% deformation) ASTM D1621: 30 psi minimum.

   c. Flexural Strength, ASTM C203: 50 psi minimum.

   d. Coefficient of Thermal Expansion, ASTM D696: 3.5 x 10-5 inches/in./F.

   e. Water Vapor Absorption, ASTM C272: Less than 0.1% by volume maximum.

   f. Water Vapor Permeance, ASTM E96: 1.1 perms/inch maximum.

   g. Flame Spread, ASTM E84: 5.

   h. Smoke Developed, ASTM E84: 165 maximum.

   i. Thickness: 2.125-inches.

   j. Width and Length: 24-inches x 96-inches: Shiplap Edge (long edge) Square Edge (short edge)

4. Product and Manufacturer: Provide one of the following:

   a. STYROFOAM PERIMATE by The Dow Chemical Company.

   b. Foamular Insul-Drain by Owens Corning

   c. CertiFoam by DiversiFoam Products

   d. Or approved equal.

B. Cavity Wall Rigid Insulation Board:

1. Rigid, rectangular boards of extruded polystyrene complying with ASTM C578, Type X and IV.

2. Provide a blowing agent with lowest available ozone depletion potential, such as HCFC-142b, or better. HCFC-141b shall not be approved by Engineer.

3. Physical Properties: Provide the following:

4. Minimum Compressive Strength, (at 10 percent de¬formation), ASTM D1621: 25 psi.

5. Flame Spread, ASTM E84: 10 maximum

6. Smoke Development, ASTM E84: 165 maximum

7. Vapor Transmission, ASTM E96: 0.4 - 1.1 perms/inch

8. Thermal Resistance, ASTM C177: 5.6/inch

9. Maximum Water Absorption, ASTM C272: 0.10% by volume

10. Size: 16-inches by 96 inches Thickness: As indicated on the contract documents.

11. Location: Against exterior face of back-up wall systems.

12. Product and Manufacturer: Provide one of the following:

    a. CAVITYMATE ULTRA and Square Edge STYROFOAM, as manufactured by: Dupont Construction Materials Company, 3115 River Road, Buffalo, NY 14207.

    b. Or approved equal.

C. Fire Safing Insulation:

1. Non-combustible, lightweight, semi-rigid mineral wool board insulation to ASTM C612 that provides fire resistance to ASTM E136 and is formadelhyde-free.

2. Physical Properties:

    a. Non-combustibility: to ASTM E136.

    b. Flame Spread: to ASTM E84: 0.

    c. Smoke Developed: to ASTM E84: 0.

    d. Firestopping: to ASTM E814.

    e. Perimeter fire containment: to ASTM E2307.

    f. Moisture sorption: 0.04% to ASTM C1104/C1104M.

    g. Corrosive resistance: to ASTM C665, Corrosive to steel – Pass.

h. Stainless steel stress corrosion: to ASTM C795.

i. Density: to ASTM C518, 4.0 pcf.

3. Thickness: as required for compression-fit

4. Size: 24-inches by 48-inches.

5. Recycled content: 70% minimum.

6. Product and Manufacturer: Provide one of the following:

a. RoxulSafe by Rockwool.

b. Thermafiber Safing by Owens Corning.

c. Or approved equal.

D. Fire-Stop Sealants and Other Fire-Stop System Components: Provide the following:

1. Complete selection of fire stop manufacturer's recommended silicone rubber fire stop systems. Provide complete systems complying with UL 1479 with a two or three hour fire rating. Provide equal fire protection as provided by fire-rating of construction penetrated.

2. Provide multiple component systems coordinated to meet actual conditions encountered in the Work and as recommended by the fire stop manufacturer. In addition to providing fire-resistance the fire stop systems shall also be gas and watertight.

E. Gap Sealant: General Purpose Type: single-component polyurethane sealant. Gun-applied and Straw-applied products, Thermal Value R3.5 per inch.

1. Provide GREATSTUFF PRO™ Gaps & Cracks Insulating Foam Sealant as manufactured by The Dow Chemical Company or approved equal.

2. Provide Substrate Cleaner as recommended by foam sealer manufacturer.

F. Miscellaneous Materials and Accessories: Provide the following:

1. Adhesive for Bonding Insulation: The type recommended by the insulation manufacturer, and complying with fire-resistance requirements.

2. Mechanical Anchors: Type and size shown or, if not shown, as recommended by the insulation manufacturer for the type of application shown and condition of substrate.

3. Adhesive Tapes: Complete selection of insulation manufacturer's recommended taping materials.

4. Bitumen: Asphalt, ASTM D449

PART 3 – EXECUTION

3.01 INSPECTION

A. The Contractor shall examine the substrate and the conditions under which the Work is to be performed, and notify Engineer in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

3.02 SUBSTRATE PREPARATION

A. Verify that surfaces to receive building insulation are clean of all debris, dirt and other contamination before installation begins in any area.

B. Correct unacceptable Work to meet the requirements of this Section.

3.03 INSTALLATION

A. General:

1. Comply with manufacturer's instructions for the particular conditions of installation in each case. If printed instructions are not available or do not apply to the project conditions, submit to Engineer specific recommendations from manufacturer for approval before proceeding with the Work.

2. Extend all insulations full thickness over entire surface to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation.

3. Install insulation to maintain continuity of thermal protection to building elements and spaces.

4. Apply the number of layers of insulation specified herein, each of the required thickness to provide the thermal value indicated, unless otherwise shown or required, to make up the total thickness.

B. Board-Type Perimeter Insulation:

1. Install perimeter insulation after concrete foundation Work has been poured and after waterproofing work is complete and acceptable to Engineer.

2. Apply continuous layer of insulation of the required thickness. Stagger joints in insulation and butt insulation tightly together.

3. Protect top surface of horizontal insulation (from damage during backfilling Work) by application of one of the types of protection course materials recommended by the insulation manufacturer.

4. On vertical surfaces, set units in adhesive applied in accordance with manufacturer's instructions. Use type of adhesive recommended by manufacturer of board-type perimeter insulation.

5. Tape bottom edge of insulation before temporarily attaching insulation to wall with mastic.

6. Tape all joints in vertical wall insulation.

7. Protect insulation on vertical surfaces (from damage during backfilling) by application of one of the types of protection course materials recommended by the insulation manufacturer. Set in adhesive in accordance with the recommendations of the manufacturers of the insulation and the protection course material.

C. Cavity Wall Rigid Insulation Board:

1. Install exterior wall rigid insulation board after all exterior unit masonry and exterior exposed Cold Rolled Metal Framing with sheathing Work is complete and prior to installation of exterior veneer materials.

2. Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

3. Apply a single layer of insulation cut to fit snugly and uniformly and in continuous contact with edges of continuous masonry horizontal joint reinforcement over the entire plane of the wall.

4. Keep insulation minimum 3-inches from heat emitting devices such as recessed light fixtures, and minimum 2-inches from sidewalls of chimneys and vents.

5. Set units in adhesive applied in accordance with manufacturer's instructions. Use type of adhesive recommended by manufacturer of board-type cavity wall insulation.

D. Safing Insulations and Fire Stop Systems:

1. Install safing insulation and fire stop systems to present a continuous fire-rated fire barrier in areas shown and at the perimeter of all fire-rated partitions and poke

through floor and wall penetrations to maintain the continuity of fire-rated construction whether or not shown.

2. Install fire stop sealants and other fire stop system components in thicknesses recommended by the manufacturer at all locations where poke through penetrations occur, all locations where other penetrations such as ducts, pipe cables, cable trays and conduit occur and at the perimeter of all fire rated walls.

3. Include all components of manufacturer's fire/smoke stop systems for complete system responsibility installed in accordance with manufacturer's written recommendations and specifications.

3.04 PROTECTION

A. All components of the Work shall be protected from detrimental weather and until construction operations including, but not limited to, backfilling, framing and sheathing, aluminum siding and concrete unit masonry Work, is completed and acceptable to Engineer.

B. Work which cannot for reasons acceptable to Engineer be covered with complete construction system before onset of weather detrimental to the Work shall be completely covered and protected in such a manner as to deflect water and weather from the installation without damaging adjacent Work.

C. Protect building insulations from all damage and abuse until Final Acceptance by the Owner.

3.05 FIELD QUALITY CONTROL

A. Submit results of all testing to Engineer along with recommendations for remedial Work. Do not delay job progress. Coordinate the submission of tests and remedial Work in a manner which does not impact the acceptability of substrate and which permits expeditious completion of the Work.

3.06 ADJUSTMENT AND CLEANING

A. Do not allow construction traffic which is not associated with the installation of the building insulation systems and related materials in the area of Work. Protect the area from access by other installers and Contractors until the Work of this Section has been incorporated into finished construction systems.

B. System components which are dislodged, damaged, expanded, broken, penetrated, or crushed by subsequent installation operations or damaged by detrimental weather shall be immediately replaced with undamaged material in compliance with the Specifications and properly protected as specified.

C. Where testing indicates that foamed-in-place building insulation has not completely filled areas to be insulated, provide remedial Work to completely fill such areas, and retest.

D. Only the original installer shall repair or replace deteriorated or defective Work.

3.07 INSPECTION AND ACCEPTANCE

A. To not allow construction traffic which is not associated with the installation in the area of Work. Protect the area from access by other installers and Contractors until the Work of this Section has been incorporated into finished construction systems.

B. System components which are dislodged, damaged, broken, penetrated or crushed by subsequent installation operations or damaged by detrimental weather shall be immediately replaced with undamaged material in compliance with the Specifications and properly protected as specified.

C. Only the original installer shall repair or replace deteriorated or defective Work.

D. Building insulations which have become wet, damaged, or deteriorated shall be promptly removed from the Site, even if discovered in the completed Work.

END OF SECTION

SECTION 07 26 13

ABOVE GRADE VAPOR RETARDERS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Wall system vapor and air barriers as specified herein shall include, but not be limited to, materials and installation methods for liquid-applied air and vapor barrier membrane system located for cavity wall surfaces under no hydrostatic pressure.

B. Wall system vapor and air barriers shall be provided where shown on the Contract Drawings, specified in this Section, or as required for a complete installation including materials and installation methods to bridge and seal air leakage pathways in roof and foundation junctions, window and door openings, control and expansion joints, masonry ties, piping and other penetrations through the wall assembly.

C. Related Specifications:

1. Section 03 30 00 – Cast-in-Place Concrete

2. Section 04 22 23.23 – Prefaced Concrete Unit Masonry

3. Section 06 10 00 – Rough Carpentry

4. Section 07 21 00 – Thermal Insulation

5. Section 07 52 00 – Built-up Bituminous Roofing

1.02 REFERENCES

A. The following standards and publications are applicable to the extent referenced in the text. The most recent version of these standards is implied unless otherwise stated.

1. American Society for Testing and Materials (ASTM)

a. C 836 Standard Specification for High Solids, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course

b. D 412 Standard Test Methods for Rubber Properties in Tension

c. D 903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds

d. D 1644 Test Methods for Non-volatile Content of Varnishes

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e. D 1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection

f. D 4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

g. D 3767 Standard Practice for Rubber - Measurements of Dimensions

h. E 96 Test Methods for Water Vapor Transmission of Materials

i. E 283 Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

j. E 2178 Standard Test Method for Air Permeance of Building Materials

k. E2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

2. NYSBC New York State Building Code and New York State Energy Conservation Code

1.03 QUALITY ASSURANCE

A. Source Quality Control:

1. Engage a single manufacturer who shall provide the services of a Technical Representative who shall assist the Contractor and the Engineer by providing technical opinions on the adequacy of materials, methods of installation and field testing methodology and significance of test results based on Working Drawings approved by the Engineer.

2. Materials: Fluid applied air and vapor barrier material shall be two part synthetic rubber based systems free of solvents, isocyanates and bitumen. For each type of material required for the work of this section, provide primary materials that are the products of one manufacturer.

3. Provide such services during the time of delivery, storage, handling, job mock-up construction, installation and testing of all components.

B. Installer Qualifications:

1. Engage a single installer skilled, trained and with successful experience in the application of each product who is a licensee of the manufacturer, or who can submit evidence in writing of being acceptable to the manufacturer and who

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agrees to employ only tradesmen with specific skill and successful experience in this type of work. Submit name and qualifications to the Engineer along with the following information on a minimum of three successful projects:

a. Names and telephone numbers of owners, architects or engineers responsible for projects.

b. Approximate contract cost of the work

c. Size of area installed

1) Installer must show evidence of adequate equipment and trained field personnel to successfully complete the project in a timely manner.

2) Submit proof of acceptability of installer by manufacturer to the Engineer.

C. Allowable Installation Tolerances:

1. Do not install work until substrate penetration and tolerances have been approved by the Engineer, air and vapor barrier manufacturer's Technical Representative and the air and vapor barrier installer, and the Contractor has verified to the Engineer that substrates are within tolerances specified and acceptable to produce approved work. Work advanced for any reason without such verification shall be stopped, removed and replaced with new material after substrate is approved at no additional expense to the Owner.

2. Substrate Tolerances:

a. Out of Plane: 1/8 inch maximum in 10 foot - 0 inches and 1/16 inch maximum in any 12 inches measured along the plane.

b. Maximum Offset in Plane Alignment: 1/16 inch.

c. Variation From Slope: 1/8 inch maximum in 10 foot - 0 inches.

D. Job Mock-Ups:

1. Prior to the installation of air and vapor barrier, but after Engineer’s approval of Working Drawing submittals, erect stepped-back job mock-ups using substrate preparation, materials and application techniques specified and approved for final work. Provide all components of the air and vapor barrier showing the correct installation, substrate preparation and the workmanship quality which shall be achieved in the work. Build mock-ups at the site, in location approved by the Engineer, of full thickness and approximately 4 feet long and 4 feet square. Indicate the proposed workmanship to be expected in the finished work. Obtain

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the Engineer's acceptance of mock-ups before start of work. Retain and protect mock-ups before start of work. Retain and protect mock-ups during construction as a standard of judging completed work. Do not alter or destroy mock-ups until given written permission by the Engineer.

2. Build as many job mock-ups as necessary m order to achieve the Engineer's acceptance of the work.

3. Work which proceeds without approved job mock-ups shall be stopped, removed and re-installed, after job mock-up approval, at no additional expense to the Owner.

1.04 PERFORMANCE REQUIREMENTS

A. Provide an air and vapor barrier system to perform as a continuous barrier to air infiltration/exfiltration and water vapor transmission and to act as a liquid water drainage plane flashed to discharge any incidental condensation or water penetration.

B. Air Barriers: The building envelope shall be designed and constructed with a continuous air barrier to control air leakage into, or out of the conditioned space. An air barrier shall also be provided for interior partitions between conditioned space and space designed to maintain temperature or humidity levels which differ from those in the conditioned space by more than 50% of the difference between the conditioned space and design ambient conditions. The air barrier shall have the following characteristics:

1. It must be continuous, with all joints made airtight. It shall have an air permeability not to exceed 0.004 cfm/ft2 under a pressure differential of 0.3 in. water. (1.57 psf.) (equal to 0.02L/s/m2 @ 75 Pa.).

2. It shall be capable of withstanding positive and negative combined design wind, fan and stack pressures on the envelope without damage or displacement and shall transfer the load to the structure. It shall not displace adjacent materials under full load.

3. It shall be durable or maintainable. The air barrier shall be joined in an airtight and flexible manner to the air barrier material of adjacent systems, allowing for the relative movement of systems due to thermal and moisture variations and creep. Connection shall be made between:

   a. Foundation and walls.

   b. Walls and windows or doors.

   c. Different wall systems.

   d. Wall and roof.

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e. Wall and roof over unconditioned space.

f. Walls, floor and roof across construction, control and expansion joints.

g. Walls, floors and roof to utility, pipe and duct penetrations.

1.05 SUBMITTALS

A. The Contractor shall submit the following in accordance with the requirements of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's product data, copies of specifications, installation instructions, and substrate preparation and general recommendations from the manufacturer. Shop drawings: Show the locations and extent of air and vapor barrier system including details of typical conditions, intersections with other envelope systems and materials including flashings, sealants around miscellaneous penetrations such as conduits, pipes, etc. and details showing how gaps in the construction will be bridged and sealed.

C. Samples: Submit for approval the following:

1. Vapor and air barrier system applied to a 12-inch by 12-inch by 2-inch thick concrete sample demonstrating specified surface preparation to be used on job mock-up and specified thickness of fluid-applied waterproofing. Apply waterproofing to only one-half of the sample board, leaving the other half visible and showing specified substrate preparation.

2. Samples will be reviewed by Engineer for general appearance and as examples of the types of components to be installed on the job mock-ups. Compliance with other requirements is the responsibility of the Contractor.

D. Test Reports: Submit for approval the following:

1. Copies of test reports verifying compliance with physical properties specified herein and verification that the materials are compatible with cavity wall insulation specified in Section 07 21 00-Thermal Insulation.

2. Copies of testing agencies background and experience in performing similar tests to those specified.

E. Certificates: Submit for approval the following:

1. Copies of certificates stating that the installer has been approved or is a licensee of the manufacturer.

2. Evidence of installer's experience.

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3. Evidence prior to delivery that materials and components furnished conform with the requirements of the Specifications.

F. Statement of Application: Upon completion of the work, submit a notarized statement to the Engineer signed by the Contractor stating that the work complies with the requirements of these Specifications and the installation methods were proper and adequate for the conditions of installation and use.

1.06 DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:

1. Deliver materials in manufacturer's original, unopened and undamaged containers, with information accurately representing container contents as approved by the Engineer at time of Working Drawing submission.

2. Include the following information on the label:

a. Name of material and supplier.

b. Installation, handling and protection requirements.

3. Deliver materials in sufficient quantities to allow uninterrupted continuity of the work.

B. Storage of Materials:

1. Store materials in original, undamaged containers with manufacturer's labels and seals intact.

2. Store all materials in a dry, enclosed area, off the ground and away from all possible contact with water and in a location where temperature can be constantly maintained between 60°F and 75°F and out of direct sunlight.

3. Prevent damage to materials during storage primarily by minimizing the amount of time they are stored at the site before being incorporated into construction systems.

C. Handling of Materials:

1. Do not open containers or expose materials to detrimental conditions or physical damage. Materials which are so exposed shall be removed from the site and shall not be incorporated into the work.

2. Handle materials in a manner which prevents contamination and inclusion of foreign materials.

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3. Do not open packages or containers until all necessary preparatory work is complete, approved and installation will begin immediately. Do not allow materials to become wet or soiled or covered with ice or snow.

1.07 JOB CONDITIONS

A. Environmental Conditions:

1. Proceed with Work only when temperature and moisture conditions comply with the manufacturer's written recommendations and when no rain or other damaging environmental condition is forecast for the time when the materials will be exposed to potential damage.

2. Protect work from precipitation, frost and direct sun. Erect temporary shelters to protect work in progress.

3. Proceed with air and vapor barrier only when weather conditions will permit unrestricted use of materials and quality control of the work being installed, complying with the Specifications and with the recommendations of the air and vapor barrier manufacturer, and only when manufacturer and installer are willing to guarantee the work as required without additional reservations and restrictions.

4. Record decisions, conditions and agreements to proceed with the work when weather conditions might be unfavorable. State the reasons for proceeding, with the names of the persons involved along with the changes, if any, or revisions, requirements or terms of the Contract.

B. Protection:

1. Provide continuous protection of materials against damage, wetting and moisture absorption primarily by storing materials under cover and above ground and away from other construction traffic.

2. Protect installed materials and completed systems against damage by construction activities. Exclude all persons not involved with the work from the work area until such time as the work has been isolated from all potential damage.

C. Substitutions:

1. Do not change products, system components, installation techniques or manufacturers after Working Drawing approval by the Engineer.

2. Clearly identify, in a manner which is highlighted to the Engineer, all proposed substitutions, modifications, variations, unspecified features and “or equal" products. Provide complete comparative data with specified products at time of Working Drawing submission.

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1.08 GUARANTEES

A. Guarantee that all work performed under this Section is free from defects in material and workmanship and conforms to all standards in the manufacturer's published data sheets. The Contractor shall warrant its air and vapor barrier work for a period of two years from the date of Final Acceptance of the work.

B. In addition, the manufacturer of the air and vapor barrier shall provide the Owner with a five year guarantee warranting the work watertight and free from defects in material, abnormal aging, workmanship, and arrangement of the various parts. Comply with all requirements of the manufacturer in order to provide guaranteed construction.

PART 2 – PRODUCTS

2.01 PRODUCTS AND MANUFACTURERS

A. General: For each type of material required for the work of this Section, provide primary materials that are the products of one manufacturer.

2.02 VAPOR AND AIR BARRIERS

A. Description: a two part, self-curing, synthetic rubber based material free of solvents, isocyanates and bitumen. As manufactured by the following:

1. Perm-A-Barrier VP ® Liquid from Grace Construction Products, 62 Whittemore Avenue, Cambridge, MA. Primary Air Barrier Membrane: One component elastomeric membrane, spray applied, having the following characteristics:

    a. Air permeability: Less Than 0.002 L/s-m² @ 75 Pa (0.3 in. W.C.) to ASTM E 2178 on CMU Block;

    b. Peel adhesion to concrete block (CMU) 20 lbs/in. ASTM D903;

    c. Tensile strength 400 psi ASTM D412

    d. Elongation 350% ASTM D412

2. Air Bloc 31 as manufactured by Henry Company Inc., Cold Stream Road, Kimberton, PA 19442. Primary Air Barrier Membrane: One component elastomeric membrane, spray applied, having the following characteristics:

    a. Air permeability: 0.0002 CFM/ft² @ 1.6 lbs/ft² to ASTM E283;

    b. Air permeability: No change @ 62.8 lbs/ft² to ASTM E331;

    c. Water vapor permeance: 12.3 perms to ASTM E96 Method B;

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d. Long term flexibility to: Pass to CGSB 71-GP-24M;

e. Low temperature flexibility and crack bridging: Pass -4°F to ASTM C836;

3. Air-Shield™ LMP fluid applied vapor permeable air barrier as manufactured by W. R. Meadows, Inc. Primary Air Barrier Membrane: One component elastomeric membrane, spray applied, having the following characteristics:

a. Air Permeability ASTM E2178: < 0.004 cfm / ft2 @ 75 Pa (1.57 lbs / ft2).

b. Water Vapor Permeance ASTM E96: 12 perms.

c. Elongation ASTM D412: 1000 %.

d. Flexibility at -20oC ASTM C836 2" mandrel: Pass.

4. Or approved equal.

B. Membranes applied to concrete and allowed to cure the peel adhesion of the membrane is measured at a rate of 50 mm (2 in.) per minute with a peel angle of 90° at room temperature. Wall System Vapor and Air Barriers shall comply with the following test standards:

TEST	METHOD	CRITERIA	RESULTS
Aging/Water Penetration Resistance	AATCC 127 (Water Column)	Resist 21.6 in (55 cm) water for 5 hours before and after aging	No water penetration before and after aging. No water penetration at 332 inches (845 cm) head of water before aging
Structural Loading/ Water Penetration Testing	ASTM E 1233/ ASTM E 331	No water at exterior plane of sheathing. (exterior gypsum, Dens-Glass® Gold, plywood, OSB) after 10 cycles @ 80% design load and 75 minutes water spray at 6.24 psf (299 Pa) pressure differential with water spray rate of 5 gal/ft2·hr (3.4 L/m2·min)	No water penetration
Cyclic Pressure/Water Penetration Testing	ASTM E 283/ ASTM E 331	No water penetration or evidence of elevated moisture levels in plywood sheathing after 10 cycles of conditioning at 299 Pa (6.24 psf) positive and negative pressure followed by 75 minutes water spray at 6.24 psf (299 Pa) pressure differential with water spray rate of 5 gal/ft2·hr (3.4 L/m2·min)	No water penetration, no elevated moisture levels
Water Resistance Testing	ASTM D 2247	Absence of deleterious effects after 14 day exposure	No deleterious effects after 14 day exposure
Resistance to Mold Growth	ASTM D 3273	No mold growth after 28 days	No mold growth after 28 day exposure

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TEST	METHOD	CRITERIA	RESULTS
Freeze/Thaw Resistance	ICBO Method	No visible effects (cracking, (AC 24) checking, delamination, erosion) when viewed at 5x magnification	No visible deleterious effects, at 5x
Water Vapor Transmission	ASTM E 96 Method B (Water Method)	Measure	Sto Gold Fill®, PROSOCO R-GUARD Fill: 17.3 perms [994 ng/(Pa·s·m2)] Sto Gold Coat®, PROSOCO R-GUARD Spray Wrap: 5.7 perms [327 ng/(Pa·s·m2)]
Air Leakage:	ASTM E 2178	< 0.004 cfm/ft2) @ 1.57 psf (0.02 L/s.M2 @ 75 Pa	
Structural Integrity	ASTM E 330	2 inches (51 mm) water pressure (positive and negative) for 1 hour	No loss of structural integrity
Dry Tensile Strength	ASTM D 882	20 lbs/in (3503 N/m) minimum before and after aging	Sto Gold Fill®, PROSOCO R-GUARD Fill: 159 pli (27.8 kN/m) before aging 213 pli (37.3 kN/m) after aging
Flexibility	ASTM D 522	No cracking or delamination using 1/8" (3 mm) mandrel at 14º F (-10º C) before and after aging	No cracking or delamination before and after aging
Tensile Adhesion	ASTM C 297	>15 psi (103 kPa)	Gypsum (ASTM C 79): >30 psi (206 kPa) Gypsum (ASTM C 1177): > 30 psi (206 kPa) Exposure 1 OSB: > 50 psi (344 kPa) Exterior Plywood: > 90 psi (620 kPa)
Surface Burning	ASTM E 84	Flame Spread: <25 Smoke Developed: <450	Flame Spread: 5 Smoke Developed: 10 NFPA Class A, UBC Class 1 building material
Fire Testing	UBC 26-9	No increase in fire hazard	Pass

2.03 TRANSITION MEMBRANE

A. Description: 0.9 mm (36 mils) of self-adhesive rubberized asphalt integrally bonded to 0.1 mm (4 mil) of cross-laminated, high-density polyethylene film to provide a min. 0.1 mm (40 mil) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed.

B. Performance Requirements:

1. Water Vapor Transmission: ASTM E 96, Method B: 2.9 ng/m2sPa (0.05 perms) max.

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2. Air Permeance at 75Pa (0.3 in. water) pressure difference: 0.0006 L/(s.m2) (0.00012 cfm/ft2) max.

3. Puncture Resistance: ASTM E 154: 178 N (40 lbs.) min.

4. Lap Adhesion at –4°C (25°F), ASTM D 1876: 880 N/m (5.0 lbs./in.) of width min.

5. Low Temperature Flexibility, ASTM D 1970: Unaffected to –43°C (-45°F).

6. Tensile Strength, ASTM D 412, Die C Modified: min. 2.7 MPa (400 psi)

7. Elongation, Ultimate Failure of Rubberized Asphalt, ASTM D 412 Die C: min. 200%

2.04 FLEXIBLE MEMBRANE WALL FLASHING

A. Description: 0.8 mm (32 mils) of self-adhesive rubberized asphalt integrally bonded to 0.2 mm (8 mil) of cross-laminated, high-density polyethylene film to provide a min. 1.0 mm (40 mil) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed.

B. Performance Requirements:

1. Water Vapor Transmission, ASTM E 96, Method B: 2.9 ng/m2sPa (0.05 perms) max.

2. Water Absorption, ASTM D 570: max. 0.1% by weight

3. Puncture Resistance, ASTM E 154: 356 N (80 lbs.) min. Tear Resistance

   a. Initiation ASTM D 1004: min. 58 N (13.0 lbs.) M.D.

   b. Propagation ASTM D 1938: min. 40 N (9.0 lbs.) M.D.

4. Lap Adhesion at -4ºC (25ºF), ASTM D 1876: 880 N/m (5.0 lbs./in.) of width

5. Low Temperature Flexibility, ASTM D 1970: Unaffected to -43ºC (-45ºF)

6. Tensile Strength, ASTM D 412, Die C Modified: min. 5.5 MPa (800 psi)

7. Elongation, Ultimate Failure of Rubberized Asphalt, ASTM D412, Die C: min. 200%

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2.05 AIR & VAPOR BARRIER ACCESSORIES

A. Description: Water-based primer which imparts an aggressive, high tack finish on the treated substrate

1. Flash Point: No flash to boiling point
2. Solvent Type: Water
3. VOC Content: Not to exceed 10 g/l
4. Application Temperature: -4°C (25°F) and above
5. Freezing point (as packaged): -7°C (21°F)

B. Description: Two part, elastomeric, trowel grade material designed for use with self-adhered membranes and tapes. 10 g/l max. VOC Content.

C. Optional Primers:

1. Description: High tack water based primer. 10 g/l max. VOC content.
2. Product: Perm-A-Barrier Liquid Part B manufactured by Grace Construction Products or approved equal.
3. Description: High tack low VOC solvent based primer. <200 g/l max. VOC content.

PART 3 – EXECUTION

3.01 INSPECTION

A. The Contractor shall examine the surfaces to receive the vapor and air barrier, and the conditions under which the work is to be performed and notify the Engineer in writing of all conditions detrimental to the proper and timely completion of the work and the performance of the vapor and air barrier systems. Do not proceed with the vapor and air barrier work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

3.02 SUBSTRATE PREPARATION

A. Provide cast-in-place concrete and masonry free from voids and sharp projections before placing any Wall System Vapor and Air Barriers system. Comply with the manufacturer's instructions for the preparation of the substrates to receive the vapor and air barrier system unless more stringent conditions are specified. Surfaces to receive air barriers shall be clean and free of all foreign matter and visibly dry and free of moisture.

B. Remove surface irregularities on cast-in-place concrete and masonry, and fill all holes, honeycombs, spalls and cracks using manufacturer's recommended joint seal parging. Repair areas of unacceptable consolidation. Where necessary to remove sharp projections, grind concrete surfaces.

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C. Clean the substrate of dust, debris and other substances detrimental to the work. Remove grease, oil and other contaminants from surfaces of cast-in-place concrete, and masonry.

D. Parge all construction joints to a minimum depth of 1/8 inch and 3 inch minimum width using manufacturer's recommended joint seal parging.

3.03 INSTALLATION

A. Comply with manufacturer's instructions for the installation of cavity wall vapor and air barrier system.

1. Concrete substrate walls shall be cured for a minimum of 30 days prior to installation of vapor and air barrier system.

2. All cracks and non-working joints over 1/8 inch shall be filled using trowel grade material of the specified system.

B. Application of Transition Membranes: Apply transition membranes, before or after application of vapor and air barrier membrane. Prior to the installation of transition membranes, prime area to be detailed and allow to cure. Install transition membranes below shelf angles, overlapping edge seams a minimum of 2” and end laps a minimum of 4”.

C. Spray a continuous uniform film of vapor and air barriers at 60 min. wet film thickness using multiple, overlapping passes. When spraying use a cross-hatching technique (alternating horizontal and vertical passes) to ensure even thickness and coverage. When spraying use high pressure, airless sprays equipment approved by the manufacturer. Seal all brick-ties and other penetrations as work progresses. Carry vapor and air barriers a minimum of 2” onto the transition membranes. Review final application to ensure all substrates have been fully coated, and that there are no passages remaining for air infiltration / exfiltration, water vapor transmission or water penetration.

D. Inspect the transition and vapor and air barrier membrane before covering and repair any punctures or damaged areas.

3.04 PROTECTION

A. Protect the area from access by other installers and Contractors until the work of this Section has been incorporated into finished construction systems.

B. Protect other work from spillage of vapor and air barrier materials, and prevent materials from entering and clogging drains and conductors. Replace or restore other work which is soiled or otherwise damaged by the performance of the vapor and air barrier and associated work.

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C. Insulation and/or protection products may be installed after all membranes have cured (16-24 hours and/or firm and dry to the touch). Schedule work so that the air and vapor barrier system is covered as soon as possible after installation. If the air and vapor barrier system cannot be covered within 30 days after installation, apply temporary UV protection such as dark plastic sheet or tarpaulins or as recommended by the manufacturer.

D. System components which are dislodged, damaged, or penetrated by subsequent installation operations or damaged by detrimental conditions shall be immediately replaced with undamaged material in compliance with the Specifications and properly protected as specified.

3.05 INSPECTION AND ACCEPTANCE

A. Certify that the completed cavity wall air and vapor barrier work is in accordance with the Specifications and is waterproof, of uniform thickness and without gaps, holidays or pinholes at the time of Final Acceptance.

END OF SECTION

SECTION 07 26 16

BELOW-GRADE VAPOR RETARDERS

PART 1 – GENERAL

1.01 SUMMARY

A. The Work of this Section includes, but is not limited to, below grade vapor retarder membrane that forms an integral bond to poured concrete for use below slabs on grade.

B. Related Sections include, but are not limited to, the following:

1. Section 03 30 00 – Cast-in-Place Concrete

2. Section 07 26 13 – Above Grade Vapor Retarders

1.02 SUBMITTALS

A. Submit manufacturer's product data, installation instructions and membrane samples for approval, in accordance with the requirements of Section 01 33 00 – Submittal Procedures.

1.03 REFERENCE STANDARDS

A. The following standards and publications are applicable to the extent referenced in the text.

1. American Society for Testing and Materials (ASTM):

a. D 412 Standard Test Methods for Rubber Properties in Tension

b. D 903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds

c. D 3767 Standard Practice for Rubber - Measurements of Dimensions

d. E 96 Standard Test Methods for Water Vapor Transmission of Materials

e. E 154 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

f. E 1643 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

g. E 1745 Plastic Vapor Retarders Used in Contact with Soil or Granular fill under Concrete Slabs

2. American Concrete Institute (ACI)

a. ACI 302.1R-96 Addendum Vapor Retarder Location: For slabs with vapor-sensitive floor coverings, locate retarder in direct contact with the slab (not beneath a layer of granular fill).

1.04 QUALITY ASSURANCE

A. Materials: For each type of material required for the work of this section, provide primary materials that are the products of one manufacturer.

B. Schedule Coordination: Schedule work such that membrane will not be left exposed to weather for longer than that recommended by the manufacturer.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in labeled packages. Store and handle in strict compliance with manufacturer's instructions. Protect from damage from weather, excessive temperature and construction operations. Remove and dispose of damaged material in accordance with applicable regulations.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Integrally Bonded Vapor Protection:

1. Manufacturer:

a. Florprufe™ 120 Membrane by Grace Construction Products;

b. Or approved equal.

2. Description:

a. A 0.5mm (0.021 in) nominal thickness composite sheet membrane comprising 0.4 mm (0.016 in.) of polyolefin film, and layers of specially formulated synthetic adhesive layers.

b. The membrane shall form an integral and permanent bond to poured concrete to prevent vapor migration at the interface of the membrane and structural concrete. Provide membrane with the following physical properties:

PHYSICAL PROPERTIES Requirements as defined by ASTM E 1745		
Property	**Typical Value**	**Test Method**
Thickness (nominal)	0.5 mm (0.021 in)	ASTM D3767 Method A
Water Vapor Permeance	0.03 perms	ASTM E96 Method B *
Tensile Strength	65 lb./in	ASTM E154 *
Elongation	300%	ASTM D412
Puncture Resistance	3300 grams	ASTM D1709 *
Peel Adhesion to Concrete	>4 lb./in	ASTM D903

* ASTM E 1745 Requirements.

PART 3 – EXECUTION

3.01 EXAMINATION

A. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the Contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Earth and stone substrates shall be well compacted to produce an even, solid substrate. Remove loose aggregate or sharp protrusions. Concrete substrates shall be smooth or broom finished and monolithic. Remove standing water prior to membrane applications.

B. Installation shall be in accordance with manufacturer's instructions and ASTM E 1643–98, including but not limited to, the following:

1. Apply membrane with the HDPE film facing the prepared substrate. Remove the release liner during application.

2. Apply succeeding sheets by overlapping the previous sheet 50-mm (2 in.) along the marked lap line. End Laps should be staggered to avoid a build up of layers.

3. Taped Lap Method:

a. For additional security use Grace Preprufe® Tape, or approved equal, to secure and seal the overlaps. Overband the lap with the 100mm (4in) wide tape using the lap line for alignment. Remove plastic release liner to ensure bond to concrete.

4. Mix and apply Grace liquid detailing compound, or approved equal, to seal around penetrations such as drainage pipes, etc.

3.03 CONCRETE PLACEMENT

A. Place concrete within 30 days.

B. Inspect membrane and repair any damage with patches of Grace Preprufe® Tape or approved equal.

C. Ensure all liner is removed from membrane and tape before concrete placement.

END OF SECTION

SECTION 07 52 00
BUILT-UP BITUMINOUS ROOFING

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Furnish all labor, materials, equipment and appliances required for the complete execution of Work shown on Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 06 10 00 – Rough Carpentry

B. Section 07 21 00 – Thermal Insulation

C. Section 07 60 00 – Sheet Metal Flashing and Trim

D. Section 07 70 00 – Roof Specialties and Accessories

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of these specifications Work shall conform to the applicable requirements of the following documents:

1. ASTM D41 – Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing

2. ASTM D312 – Asphalt Used in Roofing

3. ASTM D2178 – Asphalt Felt Used in Roofing and Waterproofing

4. FS HH-I-1972/GEN – Insulation Board, Thermal, Faced, Polyurethane or Polyisocyanurate

1.04 SUBMITTALS

A. In accordance with the procedures and requirements set forth in Section 01 33 00 – Submittal Procedures, submit the following:

1. Product data for glass fiber ply sheet, modified bitumen sheet membrane, insulation and base flashing materials.

2. Manufacturer's installation instructions.

3. Shop Drawings including roof plan and flashing details and other details to show extend of work.

4. Certification that materials meet or exceed specified requirements.

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5. Certification that installer is approved by the manufacturer.

6. Copy of manufacturer's 20-year system warranty.

7. Samples of each product.

8. Color samples of cap sheet.

9. Field report at the end of all roofing and related work.

1.05 QUALITY ASSURANCE

A. Applicator: Company well experienced in modified bitumen roofing membrane application and approved by product manufacturer.

B. Products and installation shall be in accordance with the following:

1. Underwriters Laboratories, Inc. (UL): Class A Fire Hazard Classification.

2. Design roof to meet wind design criteria in the current New York State Building Code

3. Field Report: After all work has been completed, including setting of roof top equipment, and other work required on the roof, provide a report from a Professional Engineering firm or manufacturer’s representative verifying watertight and quality installation conforming to all warranty conditions. Report shall include sub surface moisture evaluations and recommendations for necessary repairs of defects and irregularities.

C. Manufacturer’s Representative: Provide a minimum of three site visits including one at start of work, one during progress and one at completion.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not apply roofing membrane during inclement weather.

B. Do not apply roofing membrane to damp or frozen deck surfaces.

C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during the same day.

D. At lower air temperatures, to assure sound adhesion, care must be exercised to provide asphalt, at the point of application, at the asphalt's equiviscous temperature (EVT) plus 20 degrees Fahrenheit or at 400 degrees Fahrenheit, whichever is higher.

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1.07 GUARANTEE

A. Provide a twenty-year total system guarantee covering the repair of leaks which result from either material or workmanship, including insulation, and attributable to ordinary wear and tear.

1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site in factory sealed cartons and crating bearing the manufacturer's labels.

B. Store materials in weather protected environment, clear of ground and moisture, in accordance with manufacturer's instructions. Maintain membranes above 50 degrees Fahrenheit prior to their installation.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Specifications provide products manufactured by one of the following:

1. The Garland Company
2. Tremco Roofing
3. Johns Manville
4. Or approved equal.

2.02 SYSTEM DESCRIPTION

A. Four ply, hot asphalt applied modified bitumen membrane system with mineral granule surface cap sheet as the fourth ply.

2.03 SHEET MATERIALS

A. Base Sheets: Glass Fiber 6 Ply Sheet: ASTM D2178, Type VI, UL Type G1 BUR.

B. Membrane: Premium, fire-retarding, modified bitumen membrane and surfaced with light colored mineral granules. ASTM D6162 Type III cap sheet shall have the following properties:

1. Minimum Thickness: 140 mils
2. Tensile Strength – (ASTM D-5147): 400 lbs.

3. Tear Strength – (ASTM D-5147): 400 lbs.

2.04 BITUMINOUS MATERIALS

A. Asphalt Bitumen: ASTM D312, Type IV

B. Asphalt Primer: ASTM D41, Asphalt/Concrete Primer

C. Asbestos-Free Cement: ASTM D 4586 Type II

2.05 INSULATION

A. Provide insulation approved by the manufacturer and in accordance with the requirements of Section 07 21 00 – Thermal Insulation.

B. Provide manufacturer's recommended high density fiberboard, 1/2 inches thick, above insulation where required by manufacturer to meet design requirements.

2.06 FLEXIBLE FLASHING

A. Manufacturer's recommended modified bitumen flashing.

2.07 ACCESSORIES

A. Roofing Nails: Galvanized or non-ferrous type and size as required to suit application.

B. Pressure Relieving Vents: Plastic or Metal one-way valves. Provide vents in accordance with manufacturer's recommendations.

C. Mechanical Fasteners for Insulation: Manufacturer's recommended fasteners and as required to meet FM I-90 requirements.

D. Traffic Surfacing: Manufacturer's standard cap sheet of a color contrasting. Provide traffic surfacing from point of access to roof installed equipment, and each side of roof installed equipment

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify deck surface is dry, sound, clean and smooth, free of depressions, waves, or projections, properly sloped to gutter.

B. Beginning of installation means acceptance of the surface of the substrates.

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3.02 PROTECTION

A. Protect building surfaces against damage from roofing work.

B. Where work must continue over finished roof membrane, protect surfaces.

3.03 INSULATION APPLICATION

A. For structural concrete decks, prime deck surface with Asphalt/Concrete Primer then embed in a 25 pound per square (plus or minus 20%) mopping of ASTM Type III or IV asphalt, two layers of insulation in accordance with manufacturer's instructions. Lay second layer of insulation with joints staggered from first layer.

B. Lay insulation boards with tightly butted, staggered joints. Cut insulation to fit neatly to perimeter blocking and around protrusions through roof.

C. Install no more insulation than can be properly covered by the end of each day with roofing membrane.

3.04 MEMBRANE APPLICATION

A. Install glass fiber ply sheets and modified bitumen sheets and flashing in accordance with manufacturer's instructions.

B. Prime all masonry and metal surfaces with GAF Asphalt/ Concrete Primer and allow to dry thoroughly.

C. Asphalt should be heated so that felts are installed with the asphalt within its equiviscous temperature range. Mop applied sheets must be installed with ASTM D 312, Type III or IV asphalt at a minimum temperature of 400 degrees Fahrenheit, at the point of application, with a target temperature of 425 degrees Fahrenheit, or 20 degrees Fahrenheit above the EVT, whichever is higher. The maximum allowable asphalt temperature, in the kettle, is 500 degrees Fahrenheit. Heat the asphalt in accordance with the manufacturer's instructions.

D. Install glass fiber ply sheets using Type IV asphalt at a rate of 25 pounds per square (plus or minus 20%).

E. Install membrane by solidly mopping in 25 pounds per square (plus or minus 20%) of asphalt to base.

F. Apply glass fiber ply sheets and membrane smoothly without wrinkles, fishmouths or tears. Provide membrane side laps of 4 inches and 6-inch end laps. Side and end laps should have 1/4-inch minimum flow out of bitumen.

G. Extend glass fiber ply sheets and membranes 2 inches past the top of the cants onto vertical surfaces.

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H. When inclement weather is expected, install a water cut-off at the end of the day's operation. Mop three plies of base sheets and one ply of membrane. Install cut-off at all exposed edges of roofing and at roof penetrations. Remove water cut-off upon resumption of work.

3.05 TRAFFIC SURFACING

A. Using maximum 10' lengths of the cap sheet membrane solidly mop one ply of smooth membrane and one surfaced membrane to the surface of the applied roof. Allow 6"-12" openings between adjacent sheets for drainage.

3.06 FLASHING

A. Install flashing according to Manufacturer's specifications.

B. Install one pressure relief vent per 1,000 square feet, or part thereof, of roof surface.

C. Seal flashing and flanges on all items setting on or protruding through the membrane. Seal flanges between two plies of membrane.

3.07 FIELD QUALITY CONTROL

A. Inspection and testing will be performed by a Professional Engineering firm or manufacturer’s representative approved by the Engineer.

B. Correct defects and irregularities reported.

3.08 CLEANING

A. Remove bituminous markings from finished surfaces. In areas where finished surfaces are soiled by asphalt or any other source of soiling caused by work of this Section, consult manufacturer of surfaces for cleaning advice and conform to those instructions.

END OF SECTION

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SECTION 07 60 00
SHEET METAL FLASHING AND TRIM

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. The general requirements for sheet metal flashing and trim for a complete water- and weather tight installation complying with all governing codes and standards.

B. The Contractor shall provide all labor, materials, equipment and incidentals necessary to perform the work of this Section as shown on the Contract Drawings, specified herein or in the Detailed Specifications, or required otherwise for a complete installation.

C. The Contractor shall implement practices and procedures to meet the project's sustainability goals as identified in the Contract Documents. The Contractor shall ensure that the sustainability requirements of this Section are implemented to the fullest extent.

1.02 RELATED SPECIFICATIONS

A. Section 04 05 13 – Masonry Mortaring

B. Section 07 52 00 – Built-up Bituminous Roofing

C. Section 07 90 00 – Joint Fillers, Sealants, and Caulking

1.03 REFERENCES

A. SMACNA "Architectural Sheet Metal Manual"

B. New York State Building Code

1.04 SYSTEM DESIGN REQUIREMENTS

A. Sheet metal flashing and trim to be provided under this Section shall include complete systems of flashing and counterflashing at penetrations in roofing; interlocking, mechanically-keyed, 3-way ribbed stainless steel metal masonry cavity wall flashing and miscellaneous system components such as cast-in-place and built-in-place reglets and other accessory components; miscellaneous flashings not supplied under the work of other Sections; miscellaneous accessories, fasteners and incidental system components.

B. Installation of the systems shall meet the requirements of FM Approval Rating Class 1-90 construction, without relying upon sealants or other non-metallic detailing and fabricating techniques to achieve weather-and watertightness.

C. Performance Criteria:

1. Sheet metal flashing and trim shall be permanently watertight, and not deteriorate in excess of manufacturers' published limitations.

2. Comply with fabrication details recommended by SMACNA and the sheet metal flashing and trim manufacturers, as approved by Engineer at time of Shop Drawing submission.

3. Provide completely weather- and watertight wall metal flashing systems. Contractor shall provide only the highest quality materials and methods of construction and installation as recommended by sheet metal flashing and trim manufacturers in compliance with governing authorities and as approved by Engineer at time of Shop Drawing submission.

1.05 QUALITY ASSURANCE

A. Engage installers skilled, trained and with successful experience in the detailing, fabrication and installation of each type of sheet metal flashing and trim work required who are recognized sheet metal contractors, equipped to perform workmanship in accordance with the Contract Documents and approved Shop Drawings so that there will be undivided responsibility for the performance of each flashing and trim component of the work.

1.06 SUBMITTALS

A. The Contractor shall submit Shop Drawings for approval of the Engineer. Submittals shall include, but not be limited to:

1. Installer Qualifications: Submit names and qualifications to

2. Engineer along with the following information on a minimum of three successful projects.

3. Names and telephone numbers of owners, architects or engineers, responsible for the projects.

4. Approximate contract prices for sheet metal flashing and trim.

5. Size of area installed

B. Samples: Submit for approval the following:

1. Typical examples of sheet metal flashing and trim profiles, 12-inches long with all fasteners, clips, and supports required for the Work. 12-

inch by 12-inch sheet of each item specified and 6-inch-long pieces of each required system component to be used in the work.

2. Each fastener type required marked as to type of material and with their intended purpose in the work.

C. Shop Drawings: Submit for approval the following:

1. Copies of manufacturers' specifications, installation instructions and general recommendations for sheet metal flashing and trim requirements.

2. Include manufacturer's data substantiating that the materials comply with the requirements.

3. Provide Shop Drawings showing the coordination of the work with masonry and metal coping.

4. Provide detailed Shop Drawings showing all profiles of sheet metal flashing and trim systems to be used in the work, fully dimensioned, located, quantified, and presented such that sequence of installation is acceptable to each interfacing material supplier.

1.07 DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:

1. Deliver materials in manufacturers' original, unopened and undamaged containers and rolls, with labels intact and legible and with information accurately representing container contents as approved by Engineer at time of Shop Drawing submission.

2. Items delivered in broken, damaged, rusted, or unlabeled condition shall immediately be removed from project site and not offered again for approval by Engineer.

B. Storage of Materials:

1. Store materials in an area protected from all construction traffic not associated with the work of this Section.

2. Store materials off the ground and in same package in which they were shipped, and on platforms protected from dirt and other contamination.

3. Store under cover and in a manner which does not permit water to remain on units.

C. Handling of Materials:

1. Protect all sheet metal flashing and trim work from dents, scratches, warps and bends.

2. Immediately after installation of each system component, remove all strippable protective films.

3. Comply with manufacturer's instructions for handling and installation of the ribbed metal cavity wall flashing materials, except where more stringent requirements are shown or specified.

1.08 PROJECT CONDITIONS

A. Protection:

1. Provide continuous protection of materials against damage primarily by storing materials under cover and above ground and away from all construction traffic.

2. Provide continuous protection of materials against wetting and contamination.

B. Scheduling:

1. Coordinate flashings with other Work to ensure secure anchorage and watertight seals, and to minimize exposure to puncture or other damage from the work of other trades.

2. Deliver materials to the site in sufficient quantities to ensure uninterrupted progress of the Work.

3. Do not proceed with the sheet metal flashing and trim Work until substrate construction, blocking, and other construction to receive the Work is completed.

4. Schedule the installation of sheet metal flashing and trim Work to coincide with the installation of waterproofing, drains, piping, blocking, nailers, framing at openings, curbs, unit masonry and other adjoining and substrate work.

5. Proceed with and complete the work only when materials, equipment and knowledgeable tradesmen required for the installation of sheet metal flashing and trim systems are at the site and are ready to follow and integrate the work of this Section with work requiring the installation of sheet metal flashing and trim.

PART 2 – PRODUCTS

2.01 MATERIALS AND MANUFACTURERS

A. Stainless Steel Flashing: ASTM A 480, brake formed AISI Type 304, 28 gauge (0.015”) stainless steel, unless otherwise indicated. 2D annealed finish, hard.

B. Solder Materials :

1. Stainless Steel: 60 - 40 tin/lead solder ASTM B 32), with acid-chloride type flux, except use rosin flux over tinned surfaces.

C. Stainless steel scuppers, leaders, elbows, spout, leader straps, support brackets, fittings, drain bars, and appurtenances shall be factory fabricated for their intended use. Stainless steel shall be in conformance with ASTM A 480, brake formed and fully welded construction AISI Type 304, 24 gauge, unless otherwise indicated. 2D annealed finished hard.

1. Size: 5-inch Plain square scupper with flange and integrated lip as detailed.

2.02 MISCELLANEOUS MATERIALS

A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory- mitered and -welded corners and junctions.

1. Material: 28-gauge stainless steel

2. Select reglet types required from subparagraphs below.

3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

4. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.

5. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.

6. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

B. Peel and Stick Membrane Flashing:

1. Provide a rubberized asphalt and polyethylene membrane complying with ASTM D1790, backed with a silicone coated release paper that maintains the adhesive quality of the rubberized asphalt.

2. Provide a rubber based primer for direct adhesion to plywood roof sheathing in areas specified to receive asphalt membrane flashing.

3. Thickness: 40 mils total thickness minimum; 4 mil high strength polyethylene film.

4. Product and Manufacturer:

a. Bituthene Ice and Water Shield as manufactured by:

1) Construction Products Division, W.R. Grace and Company

2) WinterGuard by CertainTeed Corporation

3) Or approved equal

C. Nails, Screws and Rivets: Same material as flashing sheet, or as recommended by manufacturer of flashing sheet.

D. Cleats: Same metal and gage as sheet being anchored, 2-inches wide, punched for two anchors.

2.03 FABRICATION

A. Fabricated Metal Flashing and Trim: Shop fabricate sheet metal flashing and trim to comply with profiles and sizes shown, and to comply with manufacturer's recommended details. Except as otherwise shown or specified, provide soldered flat-lock seams, and fold back metal to form a hem on the concealed side of exposed edges. Comply with metal producers' recommendations for tinning, soldering and cleaning flux from metal.

B. On all metal base and counterflashing, and trim provide completely shop-fabricated corners and special flashings; heliarc welded to insure watertight joints. Grind welds smooth so as to be indistinguishable from adjacent surfaces.

PART 3 – EXECUTION

3.01 EXAMINATION

A. The Contractor shall examine the substrate and the conditions under which the sheet metal flashing and trim work is to be performed and notify Engineer in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.

3.02 PREPARATION

A. Clean the substrate of dust, debris, substances and interferences detrimental to the Work and prepare substrates as recommended by the sheet metal manufacturer.

B. Before installing flashing and trim, verify shapes, and dimensions to be covered.

3.03 INSTALLATION

A. General:

1. Separate dissimilar metals from substrates and from each other by painting each metal surface in the area of contact with a 15-mil thick application of bituminous coating, as recommended by the manufacturers of the dissimilar metals. Comply with manufacturer's recommendations for other forms of protection of the stainless steel and aluminum against corrosion.

2. Provide thermal expansion for running trim, flashing and other items exposed for more than 15 feet - 0 inch continuous length. Maintain a watertight installation at expansion seams. Locate expansion seams at 15 feet - 0 inch intervals, and 2 feet - 0 inch each side of corners and intersections.

3. Fabricate and install the work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves and avoidable tool marks, considering the temper and reflectivity of the metal. Provide uniform, neat double-locked seams with cleats rolled into the seam and with minimum exposure of solder, welds and sealant. Except as otherwise shown, fold back the sheet metal to form a hem on the concealed side of exposed edges. All exposed edges of all sheet metal flashing shall be hemmed not less than 1/2-inch wide.

4. Conceal fasteners and expansion provisions wherever possible in exposed work and locate so as to minimize the possibility of leakage. Cover and seal work as required for a watertight installation.

5. Provide cleat-type anchorages for metal flashings and trim wherever practical, arranged to relieve stresses from building movement, and thermal expansion and contraction.

6. On vertical surfaces lap 2-piece flashings a minimum of 4 inches.

7. On sloping surfaces, for slopes of not less than 6 inches in 12 inches, lap unsealed flashings a minimum of 6 inches. For slopes less than 6 inches in 12 inches use soldered flat-locked seams.

8. For embedment of metal flashing flanges in single ply roofing or flashing or stripping, extend flanges for a minimum of 6 inches embedment.

9. Flashing to be inserted into reglets shall be installed to the full depth of the reglet with the top flange of the flashing edge turned forward to form a hook. Caulk flashing into reglets using stainless steel wedges. Fill reglet with sealant specified in Section 07 90 00 – Joint Fillers, Sealant and Caulking.

10. All ductile and cast iron pipe and fittings shall be installed in accordance with the manufacturer's recommendations and approved shop drawings. Coordinate work with Section 04 22 23.23 – Prefaced Concrete Unit Masonry.

B. FLASHING INSTALLATION

1. Flashing shall be installed at the junction between vertical and horizontal surfaces such as lintels, cornices, sills and as indicated on the contract documents.

2. Separate dissimilar metals from substrates and from each other by using peel and stick membrane flashing in the area of contact, as recommended by the manufacturers of the dissimilar metals. Comply with manufacturer's recommendations for other forms of protection of the stainless steel against corrosion.

3. Provide thermal expansion for running trim, flashing and other items exposed for more than 15 feet - 0 inch continuous length. Maintain a watertight installation at expansion seams. Locate expansion seams at 15 feet - 0 inch intervals, and 2 feet - 0 inch each side of corners and intersections.

4. Fabricate and install the work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves and avoidable tool marks, considering the temper and reflectivity of the metal. Provide uniform, neat double-locked seams with cleats rolled into the seam and with minimum exposure of solder, welds and sealant. Except as otherwise shown, fold back the sheet metal to form a hem on the concealed side of exposed edges. All exposed edges of all sheet metal flashing shall be hemmed not less than 1/2-inch wide.

5. Conceal fasteners and expansion provisions wherever possible in exposed work and locate so as to minimize the possibility of leakage. Cover and seal work as required for a watertight installation.

6. Provide cleat-type anchorages for metal flashings and trim wherever practical, arranged to relieve stresses from building movement, and thermal expansion and contraction.

7. On vertical surfaces lap 2-piece flashings a minimum of 4 inches.

8. On sloping surfaces, for slopes of not less than 6 inches in 12 inches, lap unsealed flashings a minimum of 6 inches. For slopes less than 6 inches in 12 inches use soldered flat-locked seams.

9. Flashing to be inserted into reglets shall be installed to the full depth of the reglet with the top flange of the flashing edge turned forward to form a hook. Caulk flashing into reglets using lead wedges. Fill reglet with sealant specified in Section 07 90 00 Joint Fillers, Sealants and Caulking.

10. Provide welded joints. Provide upturned, 1/2-inch wide hooked flanges, and weld between adjoining sheets; lay seam flat.

11. Downspouts shall be installed in strict accordance with the manufacturer's instructions and recommendations, and in compliance with the SMACNA Architectural Sheet Metal Manual.

3.04 FIELD QUALITY CONTROL FOR WALL FLASHING

A. Field test wall flashing after installation. After building three courses of unit masonry above area of flashing spray area with water.

B. Water leaking from the wall below the area of the wall flashing shall be evidence that the wall flashing has been improperly installed.

C. Remove unit masonry and improperly installed wall flashing and install new wall flashing. Repeat this process until the wall does not shown evidence of leakage beneath ribbed cavity wall flashing. All such remedial work shall be at no additional expense to the Owner.

D. Remove all mortar and other debris from cavity and demonstrate free flow of water from the cavity at conclusion of test.

3.05 FLOOD TEST

A. Drains shall be plugged at the termination of the tail piece, and barriers installed to contain flood water to 2-inches above the low point of the roof system.

3.06 ADJUSTMENT AND CLEANING

A. Protect sheet metal flashing and trim work until Final Acceptance of the work.

B. Do not permit workmen, or others, to step directly on flashing sheets in place, or to place or move equipment over flashing and trim surfaces. Protect surfaces during installation of permanent covering work and adjoining work.

C. Neutralize excess flux as work progresses with five percent to ten percent washing soda solution and rinse thoroughly.

D. Clean exposed surfaces of every substance which is visible or might cause corrosion or prevent uniform oxidation of the metal surfaces. Exercise extreme care to remove fluxes and ferrous metal particles, including welding splatter and grinding dust.

END OF SECTION

SECTION 07 70 00
ROOF SPECIALTIES AND ACCESSORIES

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Furnish all labor, materials, equipment and appliances required for the complete execution of Work shown on Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 06 10 00 – Rough Carpentry

B. Section 07 60 00 – Sheet Metal Flashing and Trim

C. Section 07 90 00 – Joint Fillers, Sealants and Caulking

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of these specifications Work shall conform to the applicable requirements of the following documents:

1. TT-P-641 (1) – Primer Coating, Zinc Dust - Zinc Oxide (for galvanized surfaces)

2. ASTM A 525 – Specification for General Requirements for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process

3. ASTM A 526 – Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Commercial Quality

4. ASTM B 209 – Specification for Aluminum and Aluminum-Alloy Sheet and Plate

5. Sheet Metal and Air Conditioning Contractors National Association "Architectural Sheet Metal Manual" (ASMM)

6. The Aluminum Association "Specification for Aluminum Sheet Metal Work in Building Construction."

7. American Welding Society (AWS).

8. FM Global Data Sheet 1-28 Wind Design

9. FM Gobal Data Sheet 1-49 Perimeter Flashing

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1.04 SUBMITTALS

A. In accordance with the procedures and requirements set forth in Section 01 33 00 – Submittal Procedures, submit the following:

1. Manufacturers literature and installation instructions.

2. Samples of each material listed.

3. Provide shop drawings for the full extent of each item to be provided. Provide overall plans and details of each transition. Provide details of each item.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in factory packed unopened cartons and crating bearing the manufacturer's labels.

B. Store materials in clean, dry protected area in such manner to preclude damage of any nature.

C. Handle all materials with proper care to avoid denting, marring, warping or other distortions during delivery, storage and handling.

PART 2 – PRODUCTS

2.01 MATERIALS

A. General: Provide roof specialties and accessories of design and construction compatible and approved for use with roofing manufacturer.

B. Fasteners: Provide all fasteners and attachments required to secure item to substrate and support loads required by applicable Building Code. Use only non-corrosive fasteners which are compatible with materials being joined.

C. Colors: Colors shall be selected by Owner.

2.02 GUTTERS AND DOWNSPOUTS

A. Material: 0.040 inch aluminum.

B. Design: Manufacture gutters tapered and notched to provide telescoping joint. Design gutters and downspouts to accommodate expected thermal movement.

C. Supports and Fasteners: Provide manufacturers' standard straps, brackets and fasteners. Place supports and fasteners at 36 inches on center or as recommended by the manufacturer. Finish of supports, brackets and fasteners shall match gutter and downspout.

D. Accessories: Provide end caps, flashing, trim, and other items required for a complete installation.

E. Finish: Baked on Kynar, with 20-year warranty.

2.03 ROOF CURBS

A. Material: 18 gauge, G-90 galvanized steel, 12 inches high with mitered and continuous welded corners and seams, factory installed pressure treated wood nailers, and rigid fiberglass insulation.

B. Design: Provide roof curb units manufactured to fit manufactured roof panels. Provide integral water diverter. Design roof curb to support weight of equipment. Coordinate roof curb unit with roof panel manufacturer to ensure proper fit. Roof curb shall be approved for use by manufacturer.

C. Accessories: Provide interior liner, flashing, trim and other items required for a complete installation.

2.04 GRAVEL STOPS

A. Fascia: 0.050 inches extruded aluminum of 6063-T5 alloy.

B. Cant Dam: Commercial 24 gauge galvanized steel.

C. Concealed Splice Plates: 0.032 inches aluminum and finished to match fascia. Allow 1/4" at ball butt joints per twelve feet of length for expansion.

D. Accessories

1. Prefabricated Corners: Provide manufacturer's standard mitered and welded units.

2. Scuppers: Manufacturer's standard.

E. Finish: Color Anodized in accordance with AA-C22A44, Class 1 or Clear Anodized in accordance with AA-C22A41 or "Baked" on Kynar, with 20-year warranty.

PART 3 – EXECUTION

3.01 INSTALLATION - GENERAL

A. Install roof accessories and specialties in accordance with the manufacturer's instructions. Provide a complete watertight and weatherproof installation. Install with provision for expansion and contraction.

3.02 DAMAGED MATERIAL

A. Repair or replace materials damaged during installation.

3.03 ADJUSTING AND CLEANING

A. Check levels and adjust as necessary after roofing and flashing is complete.

B. Protect materials from damage by other trades. Remove protective coatings at completion of project.

END OF SECTION

SECTION 07 90 00

JOINT FILLERS, SEALANTS AND CAULKING

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Furnish labor, materials, equipment and appliances required for the complete execution of Work shown on the Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03 15 00 – Concrete Accessories

B. Section 03 15 16 – Joints in Concrete

C. Section 03 30 00 – Cast-In-Place Concrete

D. Section 04 21 13 – Brick Masonry

E. Section 04 22 23.23 – Prefaced Concrete Unit Masonry

F. Section 08 11 19 – Stainless Steel Doors and Frames

G. Section 08 33 23 – Overhead Coiling Doors

H. Section 08 51 13 – Aluminum Windows and Frames

I. Section 08 80 00 – Glass and Glazing

J. Section 08 95 43 – Flood Vents

K. Section 10 71 19 – Flood Barriers

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. New York State Building Code and New York State Energy Conservation Code

2. ASTM C510 – Test for Staining and Color Change of Single or Multi component Joint Sealers.

3. ASTM C661 – Test for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.

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4. ASTM C793 – Test for Effects of Accelerated Weathering on Elastomeric Joint Sealants.

5. ASTM C794 – Test for Adhesion-in-Peel of Elastomeric Joints Sealants

6. ASTM C-920 – Elastomeric Joint Sealants

7. ASTM D-1056 – Flexible Cellular Materials – Sponge or Expanded Rubber

8. Federal Specifications, TT-S-00227 – Sealing Compound: Elastomeric Type, Multi-component for Caulking, Sealing, and Glazing in Buildings and Other Structures

9. SWRI – Sealant and Caulking Guide Specification

1.04 SUBMITTALS

A. In accordance with the procedures and requirements set forth in Section 01 33 00 – Submittal Procedures, submit the following:

1. Manufacturers specifications and installation instructions for each type of sealant, caulking compound and associated miscellaneous material required. Label each product submitted with Type as indicated in Paragraph 2.01.A of this Section.

2. Actual cured material samples of each type of caulking and sealant specified, 4-inches long, in each of the manufacturer's standard colors. Samples will be reviewed by Engineer for color and texture only. Compliance with other requirements is the responsibility of Contractor.

3. Compatibility tests for substrates, based on adhesion-in-peel standard test procedures and FS TT-S-0027.

4. Copies of certified laboratory test reports indicating conformance with the requirements specified.

1.05 QUALITY ASSURANCE

A. Applicator shall be a company specializing in the installation of sealants with a minimum of five years of experience.

B. Source Quality Control:

1. Engage a single manufacturer who shall provide the services of a Technical Representative who shall assist Contractor and Engineer by providing technical opinions on the adequacy of materials and methods of installation based on Working Drawings approved by Engineer.

2. Provide such services during the time of delivery, storage, handling and installation of all caulking and sealant system components.

3. Test caulking and sealants for compatibility with the substrates specified for conformance to FS TT S 0027, and recommend remedial procedures as required.

C. Installer Qualifications: Engage a single installer skilled, trained and with successful experience in the application of the types of material required and who agrees to employ only tradesmen with specific skill and successful experience in this type of work.

D. Performance Criteria: Do not provide exposed caulking and sealant work for metal batten roofing, sheet metal flashing and trim or custom preformed metal siding work in order to render the work watertight. These construction systems shall be detailed, fabricated and provided such that they are inherently watertight without the use of additional caulking, sealant, elastomeric compounds, asphaltic compounds or other similar materials.

E. Compatibility: Before purchase of each specified sealant, investigate its compatibility with the joint surfaces, joint fillers and other materials in the joint system. Provide only materials (manufacturer's recommended variation of the specified materials) which are known to be fully compatible with the actual installation condition, as shown by manufacturer's published data or certification.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in caulking and sealant manufacturer's original unopened and undamaged containers, with information accurately representing container contents as approved by Engineer at time of Working Drawing and Samples submissions.

B. Include the following information on the label:

1. Name of material and supplier.

2. Formula or specification number, lot number, color and date of manufactures.

3. Mixing instructions, shelf life and curing time when applicable.

a. Failure to comply with these requirements shall be sufficient cause for rejection of the material in question, by Engineer, and his requiring its removal from the site. Supply new material conforming to the specified requirements at no additional expense to the Owner.

C. Store materials in location protected from freezing or damage.

D. Do not use materials which are outdated as indicated by shelf life.

E. Reject and remove from the site materials within broken or damaged packaging.

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F. Do not open containers or mix components until necessary preparatory work and priming has been completed.

G. Handle materials carefully to prevent inclusion of foreign materials.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Sealants

1. Type 1: Multi-component, non-sag, low-modulus polyurethane rubber sealant meeting ASTM C-920, Type M, Grade NS, Class 25, use NT, M, A, and O. Capable of withstanding 50% in extension or compression, such as:

    a. Sikaflex-2C NS/SL by Sika Corporation;

    b. Sonolastic NP-2 by Sonneborn;

    c. DynaTrol II by Pecora Corporation;

    d. Or approved equal.

2. Type 2: Single component polyurethane sealant meeting ASTM C-920, Type S, Grade NS, Class 25, Use NT, M, A, and O. Capable of withstanding 25% in extension or compression, such as:

    a. Sikaflex 1A by Sika Corporation;

    b. DynaTrol 1-XL by Pecora Corporation;

    c. Sonolastic NP-1 by Master Builders Solutions;

    d. Or approved equal.

3. Type 3: Single component, low-modulus moisture curing silicone meeting ASTM C-920, Type S, Grade NS, Class 25, Use NT, M, G, and A. Capable of withstanding 50% extension and compression, such as:

    a. Pecora 890 by Pecora Corporation;

    b. Sonolastic Omni Seal by Master Builders Solutions;

    c. Or approved equal.

4. Type 4: Single component, mildew resistant, moisture-curing silicone meeting ASTM C-920, Type S, Grade NS, Class 25, Use NT, M, G, and A, such as:

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a. Pecora 898 by Pecora Corporation;

b. Sonolastic Omni Plus by Master Builders Solutions;

c. Or approved equal.

5. Type 5: Single component, acrylic latex meeting ASTM C-834, such as:

a. AC-20+ Silicone by Pecora Corporation;

b. Sonneborn Sonolac by Master Builders Solutions;

c. Or approved equal.

6. Type 6: High grade butyl sealant meeting Federal Specification TT-S-00-1657, such as:

a. BC-158 by Pecora Corporation;

b. or approved equal.

7. Type 7: Multi-component chemical resistant polysulfide sealant conforming to ASTM C-920, Type M, Grade NS, Class 25, such as:

a. Deck-O-Seal by W.R. Meadows;

b. Tammsflex by DuraJoint Concrete Accessories;

c. Synthacalk GC2+ by Pecora Corporation;

d. Or approved equal.

8. Type 8: Nonsag, Multi Component, traffic grade polyurethane sealant meeting ASTM C920, Type M, Grade NS, Class 25, such as:

a. T, M, A, and O. DynaTread by Pecora Corporation;

b. Sonolastic Ultra by Master Builders Solutions;

c. Or approved equal.

B. Primer: Non-staining primer recommended by sealant manufacturer for the substrates on this project.

C. Backer Rod: Closed cell foam, nonreactive with caulking materials, non-oily, and approved by the sealant manufacturer. Minimum density shall be 2.00 pounds per cubic foot. Use no asphalt or bitumen-impregnated fiber with sealants.

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D. Joint Cleaner: Recommended by sealant or caulking compound manufacturer.

E. Bond breaker: Either polyethylene film or plastic tape as recommended by the sealant manufacturer.

F. Color: Where manufacturer's standard colors do not closely match materials being sealed, provide a custom color.

G. Entry Panels, with 4" (102 mm), 5" (127 mm), 6" (152 mm) diameter ports for all interior and exterior wall installations. The aluminum panels shall be powdercoated in a color as selected by the Engineer (minimum 12 colors) and furnished with Sealing Caps and installation hardware, including #14 stainless steel screws, finishing washers, and plastic anchors.

1. Acceptable manufacturers shall be as listed below:

a. Valmont Industries, Microflect;

b. Or approved equal

PART 3 – EXECUTION

3.01 QUALITY CONTROL

A. Coordinate work with details shown on approved shop drawings prepared by other trades.

B. Verify conditions in the field.

C. Schedule work to follow closely the installation of other trades.

D. Apply sealants and related items in temperatures and dry conditions recommended by the manufacturers.

E. Do not paint sealant, unless recommended by sealant and paint manufacturer.

3.02 PREPARATION

A. Protect finished surfaces adjoining by using masking tape or other suitable materials.

B. Clean and prime joints before starting any caulking or sealing work.

C. Thoroughly clean joints and spaces of mortar and other foreign materials. Cleaning agent shall be Xylol or similar non-contaminating solvent to remove any film from metal surfaces. Masonry or concrete surfaces shall be brushed or air jet cleaned.

D. Joint Requirements

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1. All joints and spaces to be sealed in exterior work shall be less than ½-inch deep and not less than 1/4 inch wide. If joints in masonry are less than that specified herein, the mortar shall be cut out to the required width and depth. All joints and spaces to receive sealant shall be completely prepared and thoroughly dry before installation of sealant.

2. Unless otherwise specified, joints and spaces which are open to a depth of 1/2 inch or greater shall be solidly filled with back-up material to within 1/4 inch of the surface. Back-up material shall be packed tightly and made continuous throughout the length of the joints. Bond breaker shall be applied as required. If joints are less than ¼-inch deep, the back-up material may be omitted, a bond breaker substituted and the joint completely filled with sealant. The back-up material shall not project beyond the ¼-inch depth of the open space in any joint. The following width-to-depth ratio table shall be adhered to, unless otherwise recommended by manufacturer.

	Sealant Depth	
Joint Width	**Minimum**	**Maximum**
¼ inch	1/4 inch	1/4 inch
Over 1/4 inch to 1/2 inch	1/4 inch	Equal to width
Over 1/2 inch to 1 inch	1/2 inch	Equal to width
Over 1 inch to 2 inches	1/2 inch	1/2 of width

3.03 APPLICATION

A. Exercise care before, during, and after installation so as not to damage any material by tearing or puncturing. All finished work shall be approved before covering with any other material or construction.

B. Apply sealant by an approved type of gun except where the use of a gun is not practicable, suitable hand tools shall be used. Avoid applying the compound to any surface outside of the joints or spaces to be sealed. Mask areas where required to prevent overlapping of sealant.

C. All joints shall be waterproof and weathertight.

D. Point sealed joints to make a slightly concave joint, the edges of which are flush with the surrounding surfaces. Exposed joints in the interior side of the door and other frames shall be neatly pointed flush or to match adjacent jointing work.

E. Adjacent materials which have been soiled shall be cleaned immediately and the work left in neat and clean condition.

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F. Comply with sealant manufacturer's written instructions except where more stringent requirements are shown or specified and except where manufacturer's technical representative directs otherwise.

3.04 ADJUSTMENT AND CLEANING

A. Remove misplaced sealant compounds promptly using methods and materials recommended by the manufacturer, as the work progresses.

B. Allow sealants to cure and remove protective edging, of doors, louvers, saddles windows etc. as directed by the Engineer.

3.05 SCHEDULE

Schedule of Sealants

Application	Sealant	Color
Vertical and horizontal expansion and construction joints in concrete structures unless noted otherwise herein or on Drawings.	Type 1	To closely match adjacent surfaces or mortar and as selected by the Owner.
Vertical and horizontal joints bordered on both sides by masonry, precast concrete, natural stone or other porous building material, unless noted otherwise herein or on Drawings.	Type 2	To closely match adjacent surfaces or mortar and as selected by the Owner.
Vertical and horizontal joints bordered on both sides by painted metals, anodized aluminum, mill finished aluminum, PVC, glass or other non-porous building material.	Type 3	To closely match adjacent surfaces and as selected by the Owner.
Masonry expansion and control joints less than 1¼" wide.	Type 2	To closely match adjacent surfaces and as selected by the Owner.
Masonry expansion and control joints equal or greater than 1¼ inches wide and not to exceed 2”.	Type 1	To closely match adjacent surfaces and as selected by the Owner.
Interior – wood trim and finish joints.	Type 5	Color to be selected by Owner
Sanitary areas, joints in ceramic tile, around plumbing fixtures, countertops, and back splashes.	Type 4	To closely match adjacent surfaces and as selected by the Owner.
Perimeter sealing of doors, windows, louvers, piping, ducts, and electrical conduit.	Type 2 OR Type 3	To closely match adjacent surfaces and as selected by the Owner.

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Schedule of Sealants

Application	Sealant	Color
Below thresholds.	Type 6	Manufacturer's standard
Submerged in liquids.	Type 1	Manufacturer's standard
Submerged in liquids with high concentration of chlorine (> 2 ppm) or wastewater.	Type 7	Manufacturer's standard
Horizontal Joints exposed to vehicular or pedestrian traffic.	Type 8	To closely match adjacent surfaces.
Other joints indicated on the drawings or customarily sealed but not listed.	Type recommended by manufacturer	To closely match adjacent surfaces and as selected by the Owner.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 07 95 00

EXPANSION JOINT SYSTEM

PART 1 – GENERAL

1.01 SUMMARY

A. The Contractor shall provide all labor, materials, equipment, and services, and perform all operations required for completed installation of expansion joint assemblies and related work as indicated on the Contract Drawings and as specified herein.

B. The work of this Section shall include, but not be limited to, the following for seismic joint seals:

1. Roof Expansion joint assemblies.

2. Floor expansion joint cover assemblies.

3. Wall/ceiling expansion joint cover assemblies.

4. Exterior expansion joint seals (above and below grade).

5. Fire barrier systems.

C. The following index of this Section is presented for convenience:

1.02 RELATED SECTIONS

A. Section 03 15 16 – Joints in Concrete

B. Section 05 50 00 – Metal Fabrications.

C. Section 07 52 00 – Built-Up Bituminous Roofing

D. Section 07 90 00 – Joint Fillers, Sealants and Caulking

1.03 REFERENCES

A. ASTM A36 – Carbon Structural Steel

B. ASTM A283 – Low and Intermediate Tensile Strength Carbon Steel Plates

C. ASTM A786 – Rolled Steel Floor Plates

D. ASTM B209 – Aluminum and Aluminum-Alloy Sheet and Plate

E. ASTM B221 – Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes Profiles and Tubes

F. ASTM C920 – Elastomeric Joint Sealants

G. ASTM D2000 – Classification System for Rubber Products in Automotive Applications

H. ASTM E119 – Test Methods for Fire Tests of Building Construction and Materials

I. ASTM E814 – Test Method for Fire Tests of Penetration Fire Stop Systems

J. ANSI/UL 263 – Standard for Safety for Fire Tests of Building Construction and Materials

K. National Association of Architectural Metal Manufacturers (NAAMM) – Metal Finishes Manual

L. NFPA 251 – Standard Methods of Tests of Fire Endurance of Building Construction Materials

M. NYSBC – New York State Building Code and New York State Energy Conservation Code

1.04 DESCRIPTION

A. Seismic Joints

1. Seismic joint seals, generally referred to as "expansion joint" covers or assemblies, shall be furnished and installed at all seismic joints. Seismic joints are considered to be all 2-inch minimum and wider joints shown on the Contract Drawings.

2. All exterior and interior seismic joints above and below grade shall be included, except under footings and under slabs on grade.

3. All seismic joints between stationary constructions of similar or dissimilar materials shall be provided with a seal or cover assembly.

4. Seismic joint seals as indicated on the Contract Drawings are shown to demonstrate general intent only. All required locations are not specifically indicated on the Contract Drawings, but are generally specified herein.

5. Seismic joint seals are required across each joint on both sides of all horizontal, vertical, or sloped construction including, but not limited to, the following areas or conditions exposed or concealed from view:

a. Walls and foundation walls.

b. Piers and columns.

c. Slabs - top and underside.

d. Ceilings.

e. Beams.

f. Finishes.

6. Where manufacturer's standard products will not, in the judgement of the Engineer, satisfy project requirements, custom designs and fabrications shall be provided by the manufacturer.

B. Loading Characteristics: Standard floor covers should be designed to withstand a 1 square inch point load of 500 pounds minimum without damage or permanent deformation.

C. Single-Source Responsibility: Obtain expansion joint cover assemblies from one source from a single manufacturer. The manufacturer shall be required to provide technical assistance during the installation of the joint cover assemblies to insure a full performance of the systems installed.

D. Environmental Exposure: Where indicated and required for intended use each respective expansion joint assembly shall be certified as acceptable and suitable for exposure to environmental conditions, including but not limited to the following predominating conditions.

1. Exterior Use:

a. Below Grade.

b. Sunlight.

2. Interior Use:

a. Chemicals normal to the treatment plant operation and maintenance.

b. Traffic.

1.05 QUALITY ASSURANCE

A. Materials and work shall conform to the latest edition of reference specifications specified herein and to all applicable codes and requirements of local authorities having jurisdiction.

1.06 SUBMITTALS

A. Contractor shall submit Shop Drawings for approval by the Engineer. Submittals shall include, but not limited, to the following:

1. Shop Drawings showing full extent and location of all expansion joint cover assemblies; include large-scale details indicating profiles of each type of expansion joint cover assembly, splice joints between sections, joinery with other types, special end conditions, anchorages, fasteners, and relationship to adjoining work and finishes. Include description of materials and finishes and installations instructions.

2. Product Data: Submit copies of manufacturer's latest published literature for materials specified herein for approval and obtain approval before materials are fabricated and delivered to the Site. Data to clearly indicate movement capability of cover assemblies and suitability of material used in exterior seals for UV exposure.

3. Certificates: Material test reports from qualified independent testing laboratory indicating interpreting test results relative to compliance for items specified herein including but not limited to fire-rated and seismic expansion joint assemblies with requirements indicated.

4. Letter of acceptance on company letter head from the approved roof system manufacturers for work of:

    a. Section 07 52 00 – Built-Up Bituminous Roofing

5. Samples of materials specified herein shall be submitted for approval, and approval obtained before materials are delivered to the site. Samples shall include the following:

    a. Samples for each type of metal finish indicated and metal of the same thickness and alloy to be used in the Work. Where normal color and texture variations are to be expected, include two or more units in each set of samples showing limits of such variations.

    b. Samples of each type of flexible seal to be used in Work with color samples as above.

    c. Submit a 12-inch-long sample mock-up of each type of expansion joint assembly indicating location for use and referenced on Shop Drawing submittals. Each mock-up shall be provided with all the necessary components required for the final and complete assembly including fasteners appropriate to the substrate or

adjacent surfaces. All mock-ups shall be provided fully assembled to indicate final in place arrangement and to demonstrate adjacent construction. Submit separate mock-ups for joints between expansion control joints required between long assembly lengths and each type of prefabricated corner joint.

1.07 SPECIAL WARRANTY PROVISIONS / GUARANTEE PERIODS

A. The Contractor shall obtain from the manufacturer and provide to the Owner the manufacturer's standard warranty, in an acceptable form, warranting against defects in design, materials, abnormal aging, and workmanship.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Expansion joint cover assemblies shall be manufactured by:

1. EMSEAL Joint Systems LTD., 25 Bridle Lane, Westborough, MA;
2. INPRO Architectural Products, W18766 Apollo Dr S80, Muskego, WI;
3. Construction Specialties, 3 Werner Way Lebanon, NJ;
4. Or approved equal.

2.02 MATERIALS / EQUIPMENT

A. Seismic Joint Seals, Assemblies

1. Exterior:

a. Vertical: Exterior surfaces (above and below grade) including but not limited to, exposed and concealed spaces at exterior concrete, masonry, metal fascia, and coping surfaces.

1) Silicone face seal and back seal. Face seal color as selected by the Engineer.

2) Single grooved rib at face seal to be center of joint.

3) Each retainer bracket shall be continuous and shall be secured and set in a continuous seal or tape as recommended by the manufacturer and approved by the Engineer.

4) Provide manufacturer's prefabricated retainer bracket/steel angle assembly at areas as indicated on the Contract Drawings. Steel angle shall be type 304 stainless steel, primed, and painted to match exterior face seal and come prefinished ready to install at Site.

b. All exterior assemblies shall be compatible to permit continuity of exterior system components without adversely affecting required fire ratings, water tightness or weather tightness of the seals, including but not limited to, transitions from walls to floor slabs and walls to roofs.

c. Roof expansion joint is subject to acceptance of approved roof system manufacturers of:

1) Section 07 52 00 – Built-Up Bituminous Roofing

2. Interior:

a. Vertical: Masonry or concrete wall surfaces.

1) Silicone face seal with continuous groove at center at joint.

2) Provide a continuous concealed UL rated 2-hour fire barrier at all rated walls including 1 hour rated wall construction.

3) Provide rigid insulation (minimum R=10) at all exterior wall cavities at interior side of wall construction.

4) Color: As selected by Engineer.

b. Horizontal: Ceilings including suspended ceiling.

1) Silicone face seal with continuous groove at center of joint.

2) Color as selected by Engineer.

c. Horizontal: Floor surfaces.

1) All floor seal assemblies shall be provided with a UL listed 2 hour rated fire barrier below the traffic joint, and also between pairs of columns along the joint.

d. Horizontal: Underside of roof and floor construction.

1) Provide a continuous UL rated 2-hour fire barrier at all rated areas.

2) Color as selected by Engineer.

B. Structural steel shapes - ASTM A36.

C. Steel Plates - ASTM A283, Grade C.

D. Rolled Steel Floor Plates - ASTM A786.

E. Aluminum - ASTM B221, alloy 6063-T5 for extrusions, ASTM B209, alloy 6061-T6, sheet and plate.

F. Protect aluminum surfaces in contact with cementitious materials with zinc chromate primer or chromate conversion coating.

G. Stainless Steel - Type 304 with 2B finish, unless indicated otherwise, for plates, sheet, and strips.

H. Extruded Preformed Seals: Single or multilayered rubber extrusions as classified under ASTM D2000, designed with or without continuous, longitudinal, internal baffles and formed to fit compatible frames, in color indicated, or, if not indicated, as selected by the Engineer from manufacturer's standard colors.

I. Elastomeric Sealant: Manufacturer's standard elastomeric sealant complying with ASTM C920, use T, factory-formed and bonded to metal frames or anchor members; in color indicated, as selected by the Engineer from manufacturer's standard colors.

J. Exterior Seals: Typically two single layered flexible extrusions, one interior PVC and one exterior thermoplastic rubber, as classified under ASTM D2000, retained in a set of compatible frames, in color indicated, or, if not indicated, as selected by the Engineer from manufacturer's standard colors.

K. Accessories: Manufacturer's standard anchors, fasteners, set screws, spacers, flexible vapor seals and filler materials, drain tubes, adhesive and other accessories compatible with material in contact, as indicated or required for complete installations.

L. Expansion joint sealants shall conform to the applicable requirements of Section 07 90 00 – Joint Fillers, Sealants, and Caulking.

M. Coordinate work adjoining concrete with Section 03 15 16 – Joints in Concrete and structural drawing details.

N. Location of joints in cover system assemblies shall be subject to the Engineer's approval.

O. Anchoring sleeves shall be subject to the Engineer's approval. The use of plastic anchor sleeves shall be prohibited.

2.03 FABRICATION / ASSEMBLING / FINISHES

A. Fabrication

1. Provide expansion joint cover assemblies of design, basic profile, materials, and operation indicated. Select units comparable to those indicated or required to accommodate joint size, variations in adjacent surfaces, and structural movement. Furnish units in longest practicable lengths to minimize number of end joints. Provide hairline mitered corners where joint changes directions or abuts other materials. Include closure materials and transition pieces, tee-joints, corner, curbs, cross-connections, and other accessories as required to provide continuous joint cover assemblies.

2. Fabrications shall be custom fabricated as required to suit installation requirements and shall conform to the requirements of Section 05 50 00 – Metal Fabrications.

B. Metal Finishes

1. Comply with NAAMM, Metal Finishes Manual for finish designations and application recommendations, except as otherwise indicated. Apply finishes in factory after products are fabricated. Protect finishes on exposed surfaces with protective covering before shipment.

2. Aluminum Finish:

a. Clear Anodized Finish - AA-C22A41; medium matte etches finish with 0.7 mil. Minimum thick anodic coating.

b. Factory-Primed Concealed Surfaces - Protect concealed metal surfaces that will be in contact with concrete and masonry surfaces when installed by applying a shop coat of manufacturer's standard primer to contact surfaces. Provide minimum dry film thickness of 20 mils.

C. Dissimilar Materials

1. Protect dissimilar materials from deleterious interaction by coating with an asphaltic or other approved coating as recommended by the manufacturer.

PART 3 – EXECUTION

3.01 EXAMINATION / PREPARATION

A. Examination

1. Where necessary, check actual locations of walls and other construction to which Work must fit, to determine accurate field measurements before fabrication. Show recorded measurements on final Shop Drawings and coordinate fabrication schedule with construction progress to avoid delay of Work.

2. The Contractor shall make a thorough examination of all surfaces receiving the Work of this Section and before starting the installation, notify the Engineer, in writing, of any defect which would affect the satisfactory completion of the Work of this Section.

B. Preparation

1. The Contractor shall examine the Contract Drawings and Specifications in order to ensure the completeness of the Work required under this Section.

2. The Contractor shall verify all measurements and dimensions at the Site and cooperate in the coordination and scheduling of the Work of this Section with the Work of related trades, with particular attention given to the installation of items embedded in concrete and masonry so as not to delay project progress.

3. The Contractor shall provide all templates as required to related trade for location of all support and anchorage items.

3.02 INSTALLATION

A. In addition to requirements of these Specifications, the Contractor shall comply with manufacturer's instructions and recommendations as approved by the Engineer for all phases of Work, including preparation of substrate, applying materials, and protection of installed units.

B. Provide anchorage devices and fasteners where necessary for securing expansion joint cover assemblies to in-place construction, including threaded fasteners with drilled-in-fasteners for masonry and concrete where anchoring members are not embedded in concrete. Provide fasteners of metal, type, and size to suit type of construction indicated and provide for secure attachment of expansion joint cover assemblies.

C. Perform all cutting, drilling, and fitting required for installation of expansion joint covers. Install joint cover assemblies in true alignment and proper relationship to expansion joints and adjoining finished surfaces measured from established lines and levels.

D. Allow adequate free movement for thermal expansion and contraction of metal to avoid buckling.

E. Set floor covers at elevations to be flush with adjacent finished floor materials. If necessary, shim to level, but ensure base frames have continual support to prevent rocking and vertical deflection.

F. Locate wall, ceiling, roof, and soffit covers in continuous contact with adjacent surfaces. Securely attach in place with all required accessories.

G. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches on centers.

H. Maintain continuity of expansion joint cover assemblies with end joints held to a minimum and metal members aligned mechanically using splice joints. Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames.

I. Adhere flexible filler materials (if any) to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

    1. Installation of Extruded Preformed Seals - Install scales to comply with manufacturer's instruction and with minimum number of end joints.

    2. For straight sections provide preformed scales in continuous lengths.

    3. Vulcanize or heat-seal all field splice joints in preformed seal material to provide watertight joints using manufacturer's recommended procedure.

    4. Apply manufacturer's approved adhesive, epoxy, or lubricant-adhesive to both frame interfaces prior to installing performed seal.

    5. Seal transitions in accordance with manufacturer's instruction.

J. Installation of Elastomeric Sealant Joint Assemblies:

    1. Seal all end joints within continuous runs and joints at transitions in accordance with manufacturer's directions to provide a watertight installation.

    2. Install exterior flexible seal in standard lengths.

3. Seal transitions and butt joints in accordance with manufacturer's instructions.

K. Installation of Seismic Seals:

1. Install secondary seals in continuous lengths; vulcanize all filed splice joints in secondary seal material to provide watertight joints using manufacturer's recommended procedures.

2. Install primary flexible seals in standard lengths.

3. Seal transitions and butt joints in accordance with manufacturer's instructions.

L. Protect joint covers below grade with insulation board.

3.03 ADJUSTING / PROTECTION / CLEANUP

A. Do not remove strippable protective material until finish Work in adjacent areas is complete. When protective material is removed, clean exposed metal surfaces to comply with manufacturer's instructions.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 08 11 19

STAINLESS STEEL DOORS AND FRAMES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Contractor shall provide all labor, materials, tools, equipment and incidentals as shown and required to repair and existing frame, furnish and install all stainless steel doors and frames.

B. The Contractor shall be responsible for coordinating all Work in this Section with Work covered under Section 08 71 00 – Finish Hardware.

1.02 RELATED SPECIFICATIONS

A. Section 04 22 23.23 – Prefaced Concrete Unit Masonry

B. Section 06 10 00 – Rough Carpentry

C. Section 08 71 00 – Finish Hardware

1.03 REFERENCE STANDARDS

A. All Work shall comply with the New York State Building Code.

B. All Work shall be fabricated in compliance with the Hollow Metal Manufacturer's Association, the Steel Door Institute, and these Specifications.

C. AAMA 1503-98 – Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

D. ANSI A250.4 – Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcing

E. ASTM E 84 – Surface Burning Characteristics of Building Materials

F. ASTM E 90 – Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions

G. ASTM E 283 – Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

H. ASTM E 330 – Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

I. ASTM E 331 – Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

J. ASTM F 476 – Security of Swinging Door Assemblies

K. SFBC PA 201 – Impact Test Procedures

L. SFBC PA 203 – Criteria for Testing Products Subject to Cyclic Wind Pressure Loading

M. SFBC 3603.2 (b) (5) – Forced Entry Resistance Test

N. NFPA 252 – Standard Methods of Fire Tests of Door Assemblies Current Edition

O. UBC 7-2 – Fire Test of Door Assemblies

P. UL 10C – Positive Pressure Fire Tests of Door Assemblies

Q. AMCA Standard 500

R. AMCA Certified Ratings Program.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures.

1. Samples.

2. Working Drawings.

3. Test Reports.

4. Letters of Transmittal.

B. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed materials compliance with the Contract Documents.

C. Samples shall include:

1. Corner sections of frames and trim.

2. Cut-away corner sections of hollow metal doors showing internal reinforcement specified.

3. Insulating material.

4. The Engineer reserves the right to require samples showing fabrication techniques and workmanship of component parts, and the design of accessories and other auxiliary items for all door and frame Work, before fabrication of the Work proceeds.

D. Shop Drawings shall include, but not be limited to:

1. Complete layout and installation drawings and schedules with clearly marked dimensions. Drawings shall indicate details of construction, profiles, gauges, reinforcing and location of all doors and frames.

2. Include details of each door and frame type with elevations of door design types, conditions at openings, details of construction, location and installation requirements for all finish hardware and finish hardware reinforcements and details at joints, connections, and every typical composite member. Show all door and frame reinforcements including welds, plate lengths, locations, and gauges for each component of finish hardware.

3. Provide a schedule of doors and frames using same reference numbers for details and openings as those on the Drawings.

4. Provide submittal coordinated with requirements for finish hardware. Provide all template information and internal reinforcement gauges, sizes, and locations. Submit finish hardware template requirements with stainless steel door and frame submittal.

E. Test Reports: Submit for approval the following:

1. Certification of Labeled Construction for fire doors and frames.

2. Certification of Labeled Construction for doors not requiring labels but requiring labeled construction.

3. Certified laboratory test report for required performance and specified feature verification for doors and frames selected at random by Engineer for testing. At least one test shall be to verify the presence of specified Type 316 alloy for use on all doors and frames brought to the site.

4. Provide copies of material purchase receipts, for material used in this Contract, signed by a certified and licensed Notary Public, verifying that material purchased for the Work complies with material designations specified as confirmed by approved Working Drawings.

5. Final approval of all door and frame Work shall be contingent upon verification of presence of all features specified. Submit report to the Engineer for approval.

F. Letters of Transmittal: Submit letters of transmittals indicating that door and frame manufacturer has received all finish hardware template and reinforcement information before start of fabrication.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Provide stainless steel doors and frames and accessories manufactured by a single firm specializing in the production of this type of Work and complying with specified standards of ANSI, NFPA, SDI and UL.

2. Provide stainless steel doors and frames from a manufacturer who is a member of SDI. Provide proof of the certification or demonstrate that the standards and experience required for certification are possessed.

B. Requirements of Regulatory Agencies:

1. Fire rated Assemblies: Wherever fire-resistance classification is shown or scheduled for stainless steel doors and frames (3-hour, 1-1/2-hour, and similar designations), provide fire-rated assemblies investigated and tested as complete assemblies including type of fire door hardware to be used. Identify each fire door, frame, and stick system assembly with recognized testing laboratory labels, indicating applicable fire rating of both door, frame and stick assembly.

2. Construct assemblies to comply with NFPA Standard No. 80, and applicable provisions of the Building Code of New York State.

3. Oversize Assemblies: Wherever stainless steel assemblies are larger than size limitations established by NFPA, provide manufacturer’s certification that assembly has been constructed with material and methods equivalent to labeled construction.

C. Source Quality Control:

1. After Working Drawing approval by the Engineer, manufacturer shall not make any further detailing, fabrication, or specific construction changes, nor shall doors and frames be brought to the site which do not conform in all ways to approved Working Drawing submittal.

2. Doors and frames which are found to differ in any way from those approved by the Engineer at time of Working Drawing approval shall be removed from the Work and replaced with doors and frames meeting requirements, even if discovered in the finished Work, at no additional expense to the Owner.

3. The Contractor shall provide testing of up to five stainless steel flush doors and frames, selected at random by Engineer from those brought to the site for the purpose of verifying, by independent laboratory analysis, the provision of all features specified and indicated on approved Working Drawings. Any door and frame found failing to comply with specified features shall require the removal of all

doors and frames from the Project Site, even if discovered after door and frame installation, and the provision of units complying with Specifications as confirmed by independent laboratory testing, at no additional expense to the Owner.

4. Discovery of such non conforming Work shall require a complete review of all door and frame Work on site and in shop. The Contractor shall prepare additional reports and provide additional testing in order to verify to the Engineer the acceptable condition of the remainder of all other door and frame Work, at no additional expense to the Owner.

D. Allowable Tolerances:

1. Provide a pencil-line at thin butt joints.

2. Provide maximum tolerances of 1/16 inch between the Work of this Section and adjoining surfaces, with all Work plumb and true to adjoining surfaces with all miters and copes accurately formed.

3. Provide completely water- and vapor-tight joints.

1.06 DELIVERY, STORAGE AND HANDLING

A. All materials shall be boxed or crated and suitably protected prior to shipment from the factory. Protection shall be arranged to protect all hardware which may be attached.

B. The Engineer will inspect stainless steel doors and frames upon delivery for damage. Minor damage may be repaired provided the finish items are equal to new Work and acceptable to the Engineer; otherwise, remove and replace damaged items with new items meeting the requirements of this Section.

C. Failure of the Engineer to discover damaged items at time of product delivery shall not relieve the Contractor of its requirement to only include in the finished Work items meeting the requirements of this Section.

D. Storage of Material:

1. Store doors and frames at the building site under cover.

2. Place units up off the floor and not in contact with dirt, other construction materials or debris and away from all construction traffic.

3. Avoid the use of non-vented plastic or canvas shelters which could create a humidity chamber. If cardboard wrapper on doors becomes wet, remove the carton immediately.

4. Provide a 1/4-inch space between stacked doors to promote air circulation. Keep doors and frames dry and clean. Immediately clean and dry doors and frames which become wet or soiled in any way.

1.07 SCHEDULING

A. Coordinate with other Work by furnishing Working Drawings, inserts and similar items at the appropriate times for proper sequencing of construction without delays.

B. Do not install doors and frames until all Work of this and other Contracts that could damage doors and frames has been completed.

C. Provide temporary doors until construction sequencing allows installation of permanent doors without qualification of acceptable Work by Contractor.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Superior Fireproof Door Inc.;

B. Overly Door Co.;

C. Pioneer Industries;

D. Or approved equal.

2.02 STAINLESS STEEL DOORS

A. Materials:

1. Provide 16-gauge Type 316 stainless steel complying with ASTM A666. Doors shall be 1-3/4-inches thick and of sizes shown on the Contract Drawings.

2. Product and Manufacturer: Provide one of the following:

   a. Series CHS with DURA-WELD Seams by Pioneer Industries, Incorporated.

   b. Or approved equal.

3. Finish of all doors and frames shall be #4 finish.

4. All doors shall be provided with stainless steel tags, 1/2-inch diameter x 1/16-inch thick, stamped with the door number and black Japan-filled; numbers shall conform to those in the Door Schedule.

5. Glass for all doors shall be secured with 20-gauge mouldings of stainless steel fastened with stainless steel counter-sunk flat head machine screws. The mouldings shall be assembled as frames with corners welded and finished to match door material.

6. Louvers in fireproof doors shall be constructed of No. 18 gauge stainless steel and shall be equipped with a fusible link and automatic mechanism as approved by the New York State Building Code and finished to match face of door.

B. Construction

1. Interior doors shall have a one-piece kraft honeycomb core securely bonded under heat and pressure to both face sheets. Honeycomb core shall have a 1" hexagonal cell impregnated with phenolic resin. Exterior door cores shall be provided with 18-gauge stiffeners at 6-inch on center with thermafiber insulation between and be capped at top and bottom with 18-gauge channels spot welded to face sheets to prevent moisture penetrating the door. There shall be no seams on the faces or edges of the doors. Vertical edges shall be continuously heli-arc welded, full height of the door.

2. Double doors shall have applied stainless steel astragals, 1/8-inch x 1- 1/2-inch.

3. Heads and jambs of frames shall be matched, mitered, welded and finished to present a smooth surface for finishing. Provide a minimum of 3 anchors per jamb, as well as clip angle for floor anchorage. Prepare frames for all hardware at factory from templates furnished. All hardware cutouts shall be reinforced with 1/8-inch plate welded to frame; 3/16-inch plate shall be used for hinge reinforcements.

4. Jambs shall be constructed to be set on the finished floor. Rubber mutes shall be shipped attached to lock jambs on single doors and on head members for double doors.

5. Glass for all doors shall be secured with mouldings of No. 20 gauge stainless steel fastened with stainless steel counter-sunk oval head machine screws. The mouldings shall be assembled as frames with corners welded.

6. All exterior doors shall be fully weather-stripped, as called for under Section 08 71 00 – Finish Hardware. Exterior doors shall be insulated with mineral wool to a U-factor of 0.60 in accordance with the New York State Energy Code.

7. Louvers in fireproof doors shall be constructed of No. 18 gauge stainless steel and shall be equipped with a fusible link and automatic mechanism as approved by the New York State Building Code and finished to match face of door.

8. Proper concealed reinforcements of sheet or bar steel shall be provided for hardware and for all attached Work. Reinforcement for butt side of doors shall be a continuous 3/16-inch stainless steel plate. Lock reinforcement shall be No. 12 gauge stainless steel sheet. Reinforcement for door closures, holders, checks and brackets shall be No. 12 gauge plate of length as required for finish hardware.

9. Reinforce tops and bottoms of door with minimum No. 16 gauge horizontal stainless steel closing channels, as integral part of door construction, welded continuously to the outer sheets. Close top and bottom edges to provide weatherseal, using 16-gauge flush-mounted inverted closure channels continuously adhered to face sheets with structural silicone adhesive.

10. Edge profiles shall be provided on both stiles of doors beveled 1/8 inch in 2 inches.

2.03 STAINLESS STEEL FRAMES

A. Materials shall be free from defects impairing strength, durability, and/or pressed as required for their respective function. Molded Work shall have sharply defined profiles and arises, be clean and sharp. Work shall be of proper dimensions to receive work of others. The indicated and specified thicknesses of the metal are minimum.

B. Gauges for steel used in the Work of this Section shall be as follows:

STEEL WORK		**U.S. Gauge**
1	**COMBINATION METAL FRAMES AND TRIM:**	
a	Exterior Combination Frames & Trim	No. 12
b	Interior Combination Frames & Trim	No. 16
c	Interior Combination Frames & Trim for Fire Rated Frames	No. 14
d	Exterior Scribe Moulding	No. 14
e	Interior Scribe Moulding	No. 18
f	Exterior and Interior Angle Floor Knees, Adjustable Anchors, Slides and Adjustable Anchors	No. 16
g	Fillers	As Required
2	**HARDWARE REINFORCEMENT**	
a	Butts, Checks, Overhead Door Holders, Backing Pulls	3/16” Thick
b	Locking Latches	No. 12
3	**TRIM**	No. 16

2.04 STAINLESS STEEL COMBINATION FRAMES AND TRIM

A. Stainless steel combination frames and trim shall be placed at door openings, as shown on the Contract Drawings.

B. Stainless steel combination frames and trim shall be of size and approximate design shown on the Contract Drawings, have integrally molded trim and loose molds according to contours of details, reinforced, drilled tapped for hardware. The type, as detailed, covers the general run of frames for the Work but the forming shall be varied from that shown where indicated by special details or necessitated by other conditions.

C. Miter corners accurately, heli-arc weld, and dress exposed joints to render same inconspicuous. Spreaders shall be of an approved type.

D. Frames shall extend to rough concrete slab, bottoms provided with suitable angle clips for securing to jambs. Heads of frames for openings wider than 3 feet shall be reinforced with angles or channels formed of No. 10 gauge stainless steel spot welded. Where waterproofing occurs, frames shall extend 1 inch below finished floor. Where required to receive labeled ratings, frames shall be fabricated of gauges required and shall be provided with the necessary labels.

E. Provide stainless steel labels permanently attached to section of frame concealed by closed door.

F. Slots shall be provided at upper sections of vertical members for securing temporary wood blocking to which shall be nailed the braces for holding jambs in place while building walls. All doors frames shall be provided with rubber door silencers, not less than two (2) per jamb.

G. Rubber door silencers shall be shipped attached to lock jamb on single doors and on head members for double doors.

H. Provide holes as approved for fastening wood blocking and trim where such are required by the Contract Drawings.

I. Finish for stainless steel frames shall be No. 4 Finish.

2.05 ANCHORS FOR STAINLESS STEEL FRAMES

A. Door frames in concrete openings shall be anchored with 4 hex head stainless steel expansion bolts for each jamb and two hex head stainless steel expansion bolts for each head; where steel lintels occur, machine bolts shall be used. Removable stops shall be installed to cover the bolt heads, the stops to be fastened with counter sunk oval head screws.

B. Door frames in brick or hollow tile openings shall have adjustable anchors spaced 12 inches from the top and bottom of rough bucks and intermediate anchors shall be spaced not more than 30 inches apart on each side. Anchors shall slide on a No. 14 ga. 6-inch-long steel strap securely welded to rough bucks. The leg extending into the wall shall be crimped No. 14 ga. steel at least 8 inches long where possible and 3 inches

wide, except that the width shall not exceed the thickness of the masonry, nor shall the edge of the anchor come closer than 1/2 inch to the finished face of a wall.

C. Door frames in gypsum wall board partition walls shall be provided with welded-in steel anchors, which shall be screw-adjusted after the frame is installed, positioning the jambs solidly against wall structure.

2.06 FABRICATION AND WORKMANSHIP

A. All metal Work shall be accurately fabricated and neatly assembled so as to be free from dents, tool marks, warpage, buckle or open joints. All lines shall be straight and true to curvatures as required, arises and angles as sharp as practical, mouldings true to profile, mitres formed in true alignment and abutting profiles shall intersect accurately.

B. Molded members and mouldings shall be as shown on the Contract Drawings, unless otherwise approved. Stock moulding shall be as shown on the Contract Drawings unless otherwise approved. Stock mouldings which closely approximate the contours shown on the Contract Drawings will be accepted.

C. All items of template hardware, drilling and tapping shall be located by templates so that accurate alignment will be secured. Templates should be located before manufacturing is commenced.

D. All members shall be accurately fastened together so as to provide rigid construction in the assembled Work. Removable members shall be secured with countersunk head tamperproof machine screws not more than 12 inches apart. All connections, except those of removable members shall be welded or interlocked.

E. All exposed face joints between members shall be continuously welded and dressed smooth and flush to be practically invisible.

F. Sinkages, cutouts and concealed reinforcement shall be provided as required for the proper installation and attachment of all hardware.

G. Sinkages shall be provided for butts lock fronts and strikes so that the exposed surfaces of hardware will finish flush with adjacent surfaces.

2.07 LABELED WORK

A. Door openings to receive fire ratings as indicated on the Contract Drawings shall have frames and doors and equipment of gauges meeting the requirements for the rating noted by the BSA. Frames and doors shall bear the necessary label and shall be labeled separately.

B. Each labeled door and frame shall be cut and reinforced to receive the type hardware required.

2.08 HARDWARE

A. Furnish and apply, in connection with this Work, all hardware not requiring special finish such as screws, anchors, braces, bolts, etc., as required to erect this Work properly.

B. Finishing hardware will be furnished under another Section. This Contractor shall, however, receive, check, store and apply the finishing hardware insofar as it occurs in connection with Work under this Section. Protect door knobs by covering with cloth pads securely wired in place and do not apply escutcheons and other trim until directed to do so, by the Engineer.

C. Specified manufacturer's supplemental and special reinforcement for hinges, surface applied closers, holders, coordinators, stops and strikes shall be manufacturer's standard but not less than specified and recommended for maximum heavy-duty construction.

D. Prior to installation on site, prepare doors and frames to be furnished with electrified finishing hardware as indicated on the Contract Drawings and Section 08 71 00 – Finish Hardware.

PART 3 – EXECUTION

3.01 INSTALLATION

A. All doors and frames specified herein shall be neatly installed in designated locations indicated on Contract Drawings.

B. Fixed units shall be securely fastened in place and operative units adjusted to Work properly.

C. Combination frames and trim shall be securely anchored in place with jambs filled solidly with mortar.

D. Do all necessary cutting, drilling, and fitting for securing Work in position including all necessary cutting, drilling, and tapping of the Work to accommodate the Work of other trades. Drilling and tapping for non-template hardware shall be performed at the site.

E. Where the Work of repair of an existing frame to accommodate removeable vertical mullion is required. Weld and repair existing framed to accommodate custom removable mullion. All repair Work to conform to the Work of this Section. Verify existing field condition of existing frame and door make any necessary adjustments in hardware to fit and align as required to meet tolerances of this Section. Profile of removeable mullion to match and align with existing doors and frame and shall be secured with pairs of full mortised flush bolts top and bottom.

3.02 PROTECTION AND CLEANING

A. The Contractor shall provide protection against stains, dirt, or damage to the finished installation. The doors shall be adjusted at installation for proper operation. At conclusion of construction, doors shall have any final adjustments made in order to place the doors in perfect operating condition.

B. Upon completion of the project all finished Work of this Section shall be carefully cleaned. Defective finish shall be removed and refinished, and all Work left clean and perfect.

END OF SECTION

SECTION 08 33 00

FLOOD RESISTANT DOORS AND FRAMES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. The Contractor shall furnish and install all doors, Flood Resistant Doors and Frames, steel frames, hardware and associated appurtenances shown on the Contract Drawings and specified herein.

B. The Contractor shall be responsible for coordinating all work in this Section with work covered under Section 08 71 00 – Finish Hardware.

C. Related Specifications

1. Section 08 71 00 – Finish Hardware

1.02 REFERENCE

A. All work shall comply with the New York State Building Code.

B. ASTM – American Society for Testing and Materials

1. ASTM A 653/A 653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

2. ASTM A 924 – Specification for General Requirements for Steel Sheet, Metallic Coated by the Hot Dip Process

C. ANSI – American National Standards Institute

1. ANSI/DHI A115 – Specifications for Hardware Preparations in Standard Steel Doors and Frames.

2. ANSI/DHI A115.IG – Installation Guide for Doors and Hardware.

3. ANSI A156.7 – Hinge Template Dimensions.

4. ANSI A250.4 – Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcing.

5. ANSI A 250.10 – Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

6. ANSI/SDI 250.11 – Recommended Erection Instructions for Steel Frames

D. SDI – Steel Door Institute

1. SDI 105 – Recommended Erection Instructions for Steel frames
2. SDI 111 – Recommended Details and Guidelines for Standard Steel Doors and Frames and Accessories
3. SDI 117 – Manufacturing Tolerances for Standard Steel Doors and Frames
4. SDI 122 – Installation and Troubleshooting Guide for Standard Steel Doors and Frames
5. SDI 124 – Maintenance of Standard Steel Doors and Frames

E. NAAMM/HMMA – National Association of Architectural Metal Manufacturers - Hollow Metal Manufacturers Association

1. HMMA 840 – Guide Specification for Installation and Storage of Hollow Metal Doors and Frames
2. HMMA 820 TN01 – Grouting Hollow Metal Frames
3. HMMA 820 TN03 – Guidelines for Glazing of Hollow Metal Transom, Sidelight and Windows

F. Flood Resistance Preparation

1. Federal Emergency Management Agency (FEMA) Technical Bulletin 3-93, including P.E. Tested Certification to max. elevation of 16.25-feet in depth of water

G. Building Code references

1. New York State Building Code

1.03 SUBMITTALS

A. In accordance with Section 01 33 00 – Submittal Procedures, the Contractor shall submit the following:

1. Samples.
2. Working Drawings.
3. Test Reports.
4. Letters of Transmittal.

B. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed materials compliance with the Contract Documents.

C. Samples shall include:

1. Corner sections of frames and trim.

2. Cut-away corner sections of hollow metal doors showing internal reinforcement specified.

3. Insulating material.

D. Shop Drawings shall include, but not be limited to:

1. Complete layout and installation drawings and schedules with clearly marked dimensions. Drawings shall indicate details of construction, profiles, gauges, reinforcing and location of all doors and frames.

2. Include details of each door and frame type with elevations of door design types, conditions at openings, details of construction, location and installation requirements for all finish hardware and finish hardware reinforcements and details at joints, connections and every typical composite member. Show all door and frame reinforcements including welds, plate lengths, locations and gauges for each component of finish hardware.

3. Provide a schedule of doors and frames using same reference numbers for details and openings as those on the Drawings.

4. Provide submittal coordinated with requirements for finish hardware. Provide all template information and internal reinforcement gauges, sizes and locations. Submit finish hardware template requirements with stainless steel door and frame submittal.

E. Submit manufacturer’s installation instructions, including a current copy of ANSI A250.11 as part of the shop drawing submittal.

F. Test Reports: Submit for approval the following:

1. Provide New York State licensed P.E. calculations supporting FEMA compliance in accordance with the requirements stated above.

2. Certified laboratory test report for required performance and specified feature verification for doors and frames selected at random by Engineer for testing.

3. Final approval of all door and frame work shall be contingent upon verification of presence of all features specified. Submit report to the Engineer for approval.

G. Letters of Transmittal: Submit letters of transmittals indicating that door and frame manufacturer has received all finish hardware template and reinforcement information before start of fabrication.

1.04 QUALITY ASSURANCE

A. Provide steel doors and frames and accessories manufactured by a single firm specializing in the production of this type of Work and complying with specified standards of FEMA, ANSI, NFPA, SDI and UL.

1. Flood Doors: Shall resist hydrostatic water pressure to an elevation of 74.29' (National Geodetic Vertical Datum of 1929, NGVD29). Certified testing in test tank allowing a maximum of 10 gallons of water seepage per hour.

2. Lower Water Depths Result In More Seepage Due To Lower Pressures

B. Contractor shall select a qualified hollow metal FLOOD Door Supplier who is a direct account of the manufacturer/distributor of the products furnished. In addition, that distributor must have in their regular employment an Architectural Door Consultant (ADC), who will be available to consult with the Architect and Contractor regarding matters affecting the FLOOD door and frame opening.

C. Conform to requirements of the above reference standards. Submit test reports upon request by the Owner or Architect.

D. Source Quality Control:

1. After Working Drawing approval by the Engineer, manufacturer shall not make any further detailing, fabrication, or specific construction changes, nor shall doors and frames be brought to the site which do not conform in all ways to approved Working Drawing submittal.

2. Doors and frames which are found to differ in any way from those approved by the Engineer at time of Working Drawing approval shall be removed from the work and replaced with doors and frames meeting requirements, even if discovered in the finished work, at no additional expense to the Owner.

3. Discovery of such non-conforming work shall require a complete review of all door and frame work on site and in shop. The Contractor shall prepare additional reports and provide additional testing in order to verify to the Engineer the acceptable condition of the remainder of all other door and frame work, at no additional expense to the Owner.

E. Manufacturer Qualifications: Member of the Steel Door Institute.

F. Installer: Minimum (10) years documented experience installing products specified in this Section.

1.05 DELIVERY, STORAGE AND HANDLING

A. All materials shall be boxed or crated and suitably protected prior to shipment from the factory. Protection shall be arranged to protect all hardware which may be attached.

B. The Engineer will inspect steel doors and frames upon delivery for damage. Minor damage may be repaired provided the finish items are equal to new work and acceptable to the Engineer; otherwise, remove and replace damaged items with new items meeting the requirements of this Section.

C. Failure of the Engineer to discover damaged items at time of product delivery shall not relieve the Contractor of its requirement to only include in the finished work items meeting the requirements of this Section.

D. Storage of Material:

1. Store doors and frames at the building site under cover.

2. Place units up off the floor and not in contact with dirt, other construction materials or debris and away from all construction traffic.

3. Avoid the use of non-vented plastic or canvas shelters which could create a humidity chamber. If cardboard wrapper on doors becomes wet, remove the carton immediately.

4. Provide a 1/4-inch space between vertically stacked doors to promote air circulation. Keep doors and frames dry and clean. Immediately clean and dry doors and frames which become wet or soiled in any way.

5. Provide proper storage for doors and frames, to maintain the quality and integrity of the factory applied paint and maintain the requirements of ANSI/SDI A250.10 and HMMA 840.

1.06 SCHEDULING

A. Coordinate with other work by furnishing Working Drawings, inserts and similar items at the appropriate times for proper sequencing of construction without delays.

B. Do not install doors and frames until all work of this and other Contracts that could damage doors and frames has been completed.

C. Provide temporary doors until construction sequencing allows installation of permanent doors without qualification of acceptable work by Contractor.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Acceptable manufacturers for doors and frames specified are listed below.

1. Presray Corporation;

2. PS DOORS, Grand Forks, ND. 701-746-4519;

3. Or approved equal.

B. Provide Flood Resistant doors and frames from a single manufacturer.

2.02 FLOOD DOOR AND FRAME MATERIALS

A. Materials

1. Flood resistant doors, reinforcing and frames shall be stainless steel of the finest commercial quality in accordance with ASTM A 167 No. 14 gauge Type 304 stainless steel face sheets, of sizes shown.

2. Finish of all doors and frames shall be #4 finish.

3. Hardware Reinforcements shall be as required to resist design loads as stated above. The following are minimum requirements:

a. Hinge reinforcements for full mortise hinges: minimum 7 gage [0.180" (4.7mm)].

b. Lock reinforcements: minimum 16 gage [0.053" (1.3mm)].

c. Closer reinforcements: minimum 14 gage [0.067" (1.7mm)], 20” long.

d. Projection welded hinge and lock reinforcements to the edge of the door.

e. Provided adequate reinforcements for other hardware as required.

4. Door Construction

a. ANSI-A250.4 criteria and tested to 5,000,000 operating cycles.

b. Door core construction Honeycomb: Reinforced, stiffened, sound deadened and insulated with impregnated Kraft honeycomb core completely filling the inside of the doors and laminated to inside faces of both panels using contact adhesive applied to both panels and honeycomb core.

c. Vertical edge seams: Provide doors with continuous vertical mechanical inter-locking joints at lock and hinge edges with visible edge seams. Weld vertical seam continuously in shop. Welded Vertical Edges (W): Continuous vertical mechanical interlocking joint; edge seams welded, epoxy filled, and ground smooth.

d. Bevel hinge and lock door edges 1/8 inch (3 mm) in 2 inches (50 mm). Square edges on hinge and/or lock stiles are not acceptable.

e. Reinforce top and bottom of doors with galvannealed 14 gage, welded to both panels.

f. Gaskets shall be factory mounted with high-strength adhesive and in certain areas mechanically fastened for optimum performance. Materials shall be hi-grade neoprene and EPDM and replaceable.

2.03 FLOOD RESISTANT DOORS FRAMES

A. Materials shall be free from defects impairing strength, durability, and/or pressed as required for their respective function. Molded work shall have sharply defined profiles and arises, be clean and sharp. Work shall be of proper dimensions to receive work of others. The indicated and specified thicknesses of the metal are minimum.

B. Type 304 Stainless Steel combination frames and trim shall be placed at door openings, as shown on the Contract Drawings.

C. Stainless Steel combination frames and trim shall be of size and approximate design shown on the Contract Drawings, have integrally molded trim and loose molds according to contours of details, reinforced, drilled tapped for hardware. The type, as detailed, covers the general run of frames for the work but the forming shall be varied from that shown where indicated by special details or necessitated by other conditions.

D. Miter corners accurately, heli-arc weld, and dress exposed joints to render same inconspicuous. Spreaders shall be of an approved type.

E. Frames shall extend to rough concrete slab, bottoms provided with suitable angle clips for securing to jambs. Heads of frames for openings wider than 3 feet shall be reinforced with angles or channels formed of No. 10 gauge steel spot welded. Where waterproofing occurs, frames shall extend 1 inch below finished floor. Where required to receive labeled ratings, frames shall be fabricated of gauges required and shall be provided with the necessary labels.

1. Provide stainless steel labels permanently attached to section of frame concealed by closed door.

F. Slots shall be provided at upper sections of vertical members for securing temporary wood blocking to which shall be nailed the braces for holding jambs in place while building walls. All doors frames shall be provided with rubber door silencers, not less than two (2) per jamb.

G. Provide holes as approved for fastening wood blocking and trim where such are required by the Contract Drawings.

2.04 ANCHORS FOR STAINLESS STEEL FRAMES

A. Door and plank frames in concrete openings shall be anchored with 4 hex head stainless steel expansion bolts for each jamb and two hex head stainless steel expansion bolts for each head; where steel lintels occur, machine bolts shall be used. Removable stops shall be installed to cover the bolt heads, the stops to be fastened with counter sunk oval head screws.

2.05 FABRICATION AND WORKMANSHIP

A. All metal work shall be accurately fabricated and neatly assembled so as to be free from dents, tool marks, warpage, buckle or open joints. All lines shall be straight and true to curvatures as required, arises and angles as sharp as practical, moldings true to profile, mitres formed in true alignment and abutting profiles shall intersect accurately.

B. Molded members and moldings shall be as shown on the Contract Drawings, unless otherwise approved. Stock moulding shall be as shown on the Contract Drawings unless otherwise approved. Stock mouldings which closely approximate the contours shown on the Contract Drawings will be accepted.

C. All items of template hardware, drilling and tapping shall be located by templates so that accurate alignment will be secured. Templates should be located before manufacturing is commenced.

D. All members shall be accurately fastened together so as to provide rigid construction in the assembled work. Removable members shall be secured with countersunk head tamperproof machine screws not more than 12 inches apart. All connections, except those of removable members shall be welded or interlocked.

E. All exposed face joints between members shall be continuously welded and dressed smooth and flush to be practically invisible.

F. Sinkages, cutouts and concealed reinforcement shall be provided as required for the proper installation and attachment of all hardware.

G. Sinkages shall be provided for butts lock fronts and strikes so that the exposed surfaces of hardware will finish flush with adjacent surfaces.

2.06 HARDWARE

A. Furnish and apply, in connection with this work, all hardware in addition to all screws, anchors, braces, bolts, etc., as required to erect this work properly.

B. Finishing hardware will be furnished under this Section includes, hinges required to meet performance requirement of work of this section, finish hardware in accordance with Section 08 71 10 – Finish Hardware as follows: surface applied overhead door closers, floor stops, mortise lockset and associated miscellaneous items specified and recommended for maximum heavy-duty construction and finish hardware insofar as it occurs in connection with work under this Section. Protect door lever sets by covering with cloth pads securely wired in place and do not apply escutcheons and other trim until directed to do so, by the Engineer.

C. Specified manufacturer's supplemental, special reinforcement, for all finish hardware in accordance with performance requirements as recommended for maximum heavy-duty construction.

D. Work of cylinders and keying system to be work of Section 08 71 10 – Finish Hardware.

PART 3 – EXECUTION

3.01 INSTALLATION

A. All doors and frames specified herein shall be installed in accordance with the requirements of SDI, specified herein and as indicated on Drawings.

B. Fixed units shall be securely fastened in place and operative units adjusted to work properly.

C. Combination frames and trim shall be securely anchored in place with jambs filled solidly with mortar.

D. Do all necessary cutting, drilling and fitting for securing work in position including all necessary cutting, drilling and tapping of the work to accommodate the work of other trades. Drilling and tapping for non-template hardware shall be performed at the site.

E. Waterproofing of Flood Door System in accordance with trims shop drawings.

1. Field splice only at approved locations indicated on the shop drawings. Weld, grind, and finish as required to conceal evidence of splicing on exposed faces.

2. Waterproof frame and door installation in accordance with Savannah Trims instructions and shop drawings.

3. Seal perimeter against special flood pressure resistance fin (patent Pending).

4. Install Special Sealant Stabilizer as detailed on PE Certified shop drawings.

F. Provide full height 3/8” to 1-1/2” thick strip of polystyrene foam blocking at frames requiring grouting.

1. Apply the strip to the back of the frame, where the hinge is to be installed, to facilitate field drilling or tapping.

2. Provide Water Pressure ‘Shoe’ At Inside Base of Removable Mullions. Also Install Temporary Interior Angled Brace Per Engineering Requirements.

G. Where grouting is required in masonry, provide and install temporary bottom and intermediate wood spreaders to maintain proper width and avoid bowing or deforming of frame members. Refer to ANSI A250.11-2001, Standard.

1. Frames to receive grouting: comply with a current copy of ANSI/SDI Standard A250.8, paragraph 4.2.2, whereby grout will be mixed to provide a 4" maximum slump consistency and hand troweled into place. Do not use grout mixed to a thinner, pumpable consistency; this practice is not recommended and not permissible. Refer to HMMA 820 TN01 Grouting Hollow Metal Frames.

H. Apply hardware in accordance with hardware manufacturers’ instructions and Section 08 71 00 – Finish Hardware. Install hardware with only factory-provided fasteners. Adjust door installation to provide uniform clearance at head and jambs, to achieve maximum operational effectiveness and appearance.

3.02 ADJUSTING

A. Building Contractor shall make Final Adjustments: Adjust operating doors and hardware items just prior to final inspection and acceptance by the Owner and Architect. Leave work in complete and proper operating condition. Remove and replace defective work, including doors or frames that are damaged, bowed or otherwise unacceptable.

3.03 PROTECTION AND CLEANING

A. The Contractor shall provide protection against stains, dirt or damage to the finished installation. The doors shall be adjusted at installation for proper operation. At conclusion of construction, doors shall have any final adjustments made in order to place the doors in perfect operating condition.

B. Upon completion of the project all finished work of this Section shall be carefully cleaned. Defective finish shall be removed and refinished, and all work left clean and perfect.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 08 33 23

OVERHEAD COILING DOORS

PART 1 – GENERAL

1.01 SUMMARY

A. Principal items of work under this Section include:

1. Manually operated overhead coiling doors;

2. Electrically operated overhead coiling doors.

B. Furnish all labor, materials, equipment and incidentals required for performing the Work of this Section as specified, shown on the Contract Drawings or required for a complete job.

C. The Contractor shall implement practices and procedures to meet the Project's sustainability goals as identified in the Contract Documents. The Contractor shall ensure that the sustainability requirements of this Section are implemented to the fullest extent.

1.02 RELATED SECTIONS

A. Section 04 22 23.23 – Prefaced Concrete Unit Masonry

B. Section 05 50 00 – Metal Fabrications

C. Section 07 90 00 – Joint Fillers, Sealants and Caulking

D. Section 09 91 00 – Painting

E. Division 26 - Electrical

1.03 REFERENCES

A. NYSBC – New York State Building Code

B. NFPA 70 – National Fire Protection Associations, National Electric Code

C. NAAMM AMP 500 – National Association of Architectural Metal Manufacturers, Architectural Metal Products Division

D. Green Seal

1. GS–11 – Green Seal Standard for Paints, Coatings, Stains and Sealers

2. GC–3 – Green Seal Environmental Criteria for Anti-Corrosive Paints.

E. UL 325 – Underwriter Laboratories Standard for Safety, Door, Drapery, Gate, Louver and Window Operators, and Systems

1.04 DESCRIPTION

A. All equipment tests shall be performed in accordance with the requirements of the Contract Documents

B. Sustainable design requirements

1. Recycled Content of Overhead Coiling Doors: Postconsumer recycled content plus one-half of pre-consumer recycled content shall not be less than 35 percent, measured as a percentage (%) by weight of the final assembled product.

2. VOC Content: Products applied on site and within the building's weatherproofing system shall comply with VOC limits of authorities having jurisdiction and the following VOC limits of when calculated according to SCAQMD Rule 1113 and Rule 1168, Green Seal Standard GS–11, and Green Seal Standard GC–3:

a. Architectural Sealants: 250 g/L

b. Metal-to-Metal Adhesives: 30 g/L

c. Multipurpose Construction Adhesives: 70 g/L

d. Flat Paints and Coatings: VOC not more than 50 g/L

e. Non-flat Paints and Coatings: VOC not more than 150 g/L

f. Primers, Sealers, and Under-coaters: VOC not more than 200 g/L

g. Anticorrosive and Antirust Paints Applied to Ferrous Metals: VOC not more than 250 g/L

1.05 QUALITY ASSURANCE

A. The following tests are required:

1. Certified Shop Tests: Motor tests in accordance with Division 26 – Electrical.

1.06 SUBMITTALS

A. Contractor shall submit Shop Drawings for approval by the Engineer in accordance with Section 01 33 00 – Submittal Procedures. Submittals shall include, but not be limited to the following:

1. Samples.
2. Shop Drawings.
3. Certified reports of motor tests.
4. Manufacturer’s warranty for galvanized coatings and component parts.
5. Operation and Maintenance Manuals.

B. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed materials compliance with the Contract Documents.

C. Samples shall include finish and color samples for all items.

D. Shop Drawings shall include:

1. Equipment specifications and data sheets identifying all materials used and methods of fabrication.
2. Complete assembly, layout and installation drawings and schedules with clearly marked dimensions.
3. Electrical motor nameplate data as specified in Section 26 05 60 – Low-Voltage Electric Motors.
4. Interconnecting wiring diagrams.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials:

1. Materials shall not be delivered to the Project Site before the time of installation.
2. Materials shall be delivered in sufficient quantities to allow continuity of the Work.

B. Storage of Materials:

1. Materials shall be stored in original, undamaged packaging with the manufacturer’s labels and seals intact.
2. All materials shall be stored in a dry, enclosed area, off the ground and away from all possible contact with water, ice, or snow.

3. Damage to materials during storage shall be prevented primarily by minimizing the amount of time they are stored at the Site before being incorporated into construction systems.

C. Handling of Materials:

1. Materials shall be handled carefully in order to avoid damage or breakage.

2. Materials shall not be exposed to detrimental conditions or physical damage. Materials which are so exposed shall be removed from the Site and shall not be incorporated into the Work.

3. Packages shall not be opened until all necessary preparatory Work is complete and installation is to begin immediately. Materials shall not be allowed to become wet or soiled or covered with ice or snow.

1.08 SPARE PARTS, SPECIAL TOOLS, AND SUPPLIES

A. Spare parts for motors shall be provided in accordance with Section 26 05 60 – Low-Voltage Electric Motors

1.09 WARRANTY

A. In accordance with the General Contract Conditions as modified by the Special Contract Conditions, The Contractor shall submit a 1-year bonded warranty. The warranty shall include the replacement of any parts due to imperfections, by reason of defective materials, workmanship or arrangement of the various parts. Such replacement shall be performed in accordance with the manufacturer's recommendations and the manufacturer's installation guarantee if any of the Work of this Section is found to be defective because of poor material or installation or is not in accordance with the Contract Documents. Such replacement shall occur within one (1) year after receipt of a written notice from OWNER. The Contractor shall provide a letter from its surety company with bid confirming that they can furnish a 1-year bonded warranty.

B. In addition to above Contractor shall provide OWNER with manufacturer's standard warranty for the overhead coiling door.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. All coiling door components and assemblies indicated as Work of this Section shall be from a single manufacturer.

B. Provided electrically operated Overhead Coiling Door shall be UL 325 listed, including but not limited to all entrapment requirements and options as specified herein, as manufactured by the following:

1. Thermiser Insulated Overhead Coiling Door, Model ESD20-SG, by Cornell Iron Works, Inc., Underwriters Laboratories, Inc. (UL), ISO 9002 Registered;

2. Or approved equal.

2.02 MATERIALS / EQUIPMENT

A. Stainless steel slats shall be 20 gauge, #2D dull finish. Slats for door shall be assembled of interlocking slats "Series 625, F-265I Slat" with an interlocking inside face enclosing and protecting the foamed in-place polyurethane insulation or approved equal. Slats shall be 3/4-inch thick and 2-5/8 inches high. Polyurethane insulation shall be foamed in place after individual slats have been assembled and in such a manner as to fill all voids to provide continuous insulation for the full height of slat. Insulation shall be self-bonding to the two faces of the slats.

1. Slats shall have end locks locking each end of alternate slats to act as wearing surfaces and to maintain slat alignment. Slats shall adequately withstand a wind load of 20 psf when subjected to an 87-mph wind.

2. Slats to be provided with a cloth interwoven neoprene loop astragal at the bottom bar to serve as a weather seal at sills.

3. A continuous thermal break shall be provided from sill to above lintel without metal contact on the interior side of door.

B. Slats shall have a minimum R-Value of 8.0 hr/btu/sq. ft/deg. F.

C. Counterbalance shall consist of steel pipe or barrels of proper diameter and thickness to carry the dead load and not deflect in excess of 0.03 inches per foot of opening width and evenly balanced by helical springs within the pipe. Ends shall be fitted with collar bearings and self-lubricating bushings. Ends of shaft to be closed with heavy malleable iron plugs machined to completely fill the openings.

1. The counterbalancing mechanism shall consist of oil-tempered helically-wound torsion springs capable of correctly counter- balancing the curtain at any point and with a safety factor 25 percent greater than the actual weight of the curtain, and shall be equipped with spring adjustment devices of the self-sustaining worm and wheel type to vary the spring charge through the crankshaft extending through the hood.

2. Barrels shall be of 2-piece pivoted construction for removal from the shaft without dismantling the shaft from the brackets.

D. Brackets shall be heavily proportioned of stainless steel, 1/4-inch thick, and shaped to form an end closure support for protection of operating gears and shall be provided with bracket hubs of sufficient thickness to provide ample bearing surface for load of roller shaft and curtain.

E. Gears shall be certified grey iron castings with teeth cast from machine cut patterns. Journals shall be cold rolled steel studs riveted to brackets.

F. Coil hood shall be steel framed enclosures of ASTM A 653 galvanized base steel to contain the operating mechanism and the supporting discs and drums to receive the coiling curtains. Steel framing and sheet steel faced hoods shall be provided under this Section. Coil hood facing shall be of not less than No. 24 gauge, reinforced with manufacturer's standard bands twelve (12) inches on center. Finish of hood shall be as follows:

1. Polyester base coat and final powder coating system with a dry film thickness of two and one-half (2-1/2) mils with a pencil hardness of H per ASTM-D-3363 Hood Color: to be standard light gray.

G. Weather-stripping at guide rails shall consist of a vinyl material mounted on spring metal and attached to the guide rails with stainless steel screws. A compressible neoprene safety edge weather-strip shall be fastened securely to the bottom bar of the curtain.

H. Sound Transmission Class (STC) rating:

1. 21 minimum

I. Motor operators shall include motor, reduction gears, automatic safety devices, control switches, limit switches and emergency chain-hoist operator. Components of the electric operator are as follows:

1. Motor shall be type "RSX" pre-wired high starting torque, or approved equal, NEMA 7 type heavy duty, instantly reversible, with sealed ball bearings lubricated for life, of sufficient horsepower to raise and lower the door at 8 inches to 12 inches per second without overloading the motor (maximum ¾ horsepower). Motor shall be removable without precluding the use of the emergency hood chain hoist operator or disrupting the timing of the geared limit switch. All operators shall be pre-wired. Electrical characteristics for overhead door shall be 208V, 3 phase, 60 Hz. All electrical devices shall comply with NEMA 7 requirements.

2. Reduction gears shall be machine-cut gears completely housed and running in an oil bath. Speed reduction shall be worm-gear-in-oil-bath gear reducer with synthetic "All Climate" oil.

3. Magnetic reversing starter shall be of the internal type with thermal overload protection and reset button.

    a. Control Station: Wall mounted, "Open/Close" key switch; To comply with NEMA 7.

4. Control switches for the door shall be provided and located where shown on the Contract Drawings or as directed by the Engineer.

5. Limit switches shall be of the rotary type with worm and gear driven by a timing chain. Cams on gear shall operate micro-type switches allowing Vernier adjustment. Geared limit switch shall contain a spare set of contacts.

6. Emergency manual chain-hoist operator shall be provided to allow hand operation of door in the event of a power failure. A safety interlock switch shall be provided which shall automatically prevent the electric motor from operating when the emergency chain-hoist operator is in neutral or is engaged. Emergency operation of the doors shall not affect the timing of the limit switches.

7. Magnetic reversing starter shall be of the internal type with thermal overload protection and reset button.

2.03 FABRICATION / ASSEMBLING / FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products (AMP 500)" for recommendations for applying and designating finishes.

B. All surfaces of ferrous metals shall be shop painted. Galvanized steel shall be chemically cleaned and bonderized prior to shop painting. Parts inaccessible after installation shall be given an additional coat in the shop. Finish painting to be performed under Section 09 91 00 – Painting.

C. Stainless steel slats shall have a 2D dull Finish

2.04 SOURCE QUALITY CONTROL / SHOP TESTS

A. Certified shop tests for motors shall be performed in accordance Division 26 – Electrical.

PART 3 – EXECUTION

3.01 EXAMINATION / PREPARATION

A. Examine the substrates and adjoining conditions where the coiling door is to be installed. Unsatisfactory conditions shall be corrected, in a manner acceptable to the Engineer, prior to proceeding with the Work.

3.02 INSTALLATION

A. Install all units and operating equipment complete with necessary hardware, jamb, and head moldings, anchors, inserts, hangers and equipment supports in accordance with final approved Shop Drawings, manufacturer's printed instructions and as specified herein.

B. Field touch-up painting of all surfaces scratched or abraded during installation.

C. Do all cutting, drilling, fitting and other Work of similar character required for fitting and setting units in connection with this Work and adjoining Work of other trades.

3.03 FIELD TESTING / QUALITY CONTROL

A. Field tests for motors shall be performed in accordance with Division 26 – Electrical.

3.04 STARTUP / DEMONSTRATION

A. The Contractor shall provide acceptance testing of motors in accordance with Division 26 – Electrical.

3.05 ADJUSTING / PROTECTION / CLEANUP

A. Protect units prior to, during and after installation. Protection shall remain in-place until all Work which may cause damage or defacement has been completed.

B. After installation, including Work by other trades and Contracts, lubricate, test and adjust all overhead coiling door units to operate easily, free from warps, twists or distortion and that weather tight fit has been provided for the entire perimeter of the door.

END OF SECTION

SECTION 08 51 13

ALUMINUM WINDOWS AND FRAMES

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Furnish labor, materials, equipment and appliances required for complete execution of Work shown on Drawings and specified herein.

B. This section describes the general requirements for a complete thermally broken aluminum windows.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 06 10 00 – Rough Carpentry

B. Section 07 90 00 – Joint Fillers, Sealants and Caulking

C. Section 08 80 00 – Glass and Glazing

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of these specifications, the Work shall conform to the applicable requirements of the following documents:

1. ASTM E 283 – Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors

2. ASTM E 330 –- Test Methods for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference

3. ANSI/AAMA 101 – Voluntary Specification for Aluminum Sliding Doors and Windows

4. Applicable standards of North American Fenestration Standard / Specification For Windows, Doors, and Skylights

1.04 SUBMITTALS

A. In accordance with the procedures and requirements set forth in Section 01 33 00 – Submittal Procedures, submit the following:

1. Manufacturer's Literature

2. Shop Drawings shall include, but not be limited to:

a. Complete assembly, layout and installation drawings and schedules with clearly marked dimensions. Drawings shall indicate gages, sizes, shapes of

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members, methods of shop joinery, field assembly and connections to abutting construction.

b. Detail drawings indicating reinforcement and stiffening members required.

c. Detail drawings of all required anchoring and fastening devices.

3. Test Reports: Submit certified independent laboratory test reports verifying compliance with all test requirements and structural calculations prepared by registered Structural Engineer and indicating adequacy of all installed materials to meet the uniform and structural load requirements as specified.

4. Samples shall include:

a. Finish samples.

b. Section of frames and ventilators.

c. Rough hardware.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Specifications, provide fixed or operable windows and accessories manufactured by one of the following:

1. Three Rivers Aluminum Company (TRACO),

2. Kawneer

3. Peerless Products, Inc.

4. EFCO Corporation

5. Or approved equal.

2.02 GENERAL

A. Field verify all dimensions and conditions affecting the Work before fabrication of windows.

B. Incorporate head and sill receptors, and water deflectors to provide internal drainage. Utilize stainless, or other steel non-corrosive fasteners.

C. Set windows in their correct locations level, square, plumb and at proper elevations and in alignment with other Work.

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D. Isolate aluminum surfaces in contact with dissimilar metals with a bituminous coating or other approved isolator.

E. Seal joints weather tight.

F. Design frame assemblies and glazing attachments to withstand a minimum uniform wind load of 40 lbs. per square foot. The maximum deflection permitted in any span shall be 1/175 of the span.

G. Coordinate Work with Section 08 80 00 – Glass and Glazing.

2.03 MATERIALS

A. Provide windows with AAMA "Quality Certified" label in accordance with ANSI/AAMA 101, performance class P-HC40 and the following requirements:

1. Aluminum shall be of commercial quality and of proper alloy for window construction, free from defects impairing strength and durability. All extruded sections shall be of 6063-T5 alloy temper with a minimum ultimate tensile strength of 22,000 P.S.I. and a yield of 16,000 P.S.I.

2. Air infiltration – ASTM E-283 shall not exceed .06CFM per s.f. of fixed area.

3. Water infiltration – ASTM E331 – no water infiltration at a test pressure of ten PSF.

4. Aluminum: Extruded 6063-T5 or T6 alloy and temper as recommended by aluminum-framed door manufacturer to comply with the requirements of performance, strength, corrosion resistance, fabrication, application of required finish and control of color.

B. Thermally Broken Aluminum Windows:

1. Aluminum Extrusions:

a. Not less than 0.070" (1.8 mm) wall thickness at any location for the main frame.

b. Complying with ASTM B221: 6063-T6 alloy and temper.

c. Recycled Content: Shall have a minimum of 40% mixed pre- and post-consumer recycled content.

d. Fabrication: All framing shall be a minimum of 3 inches in depth. Frame and ventilator extrusions shall have a minimum wall thickness of .080 inches, of one part construction incorporating a thermal barrier. Ventilators shall be tubular. Corner construction shall be mitered with clip, epoxy, stake attachment. All frame corners and meeting rail intersections shall be coped

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and tenon joined and forged. All corners and intersections shall be made permanently leak proof. Minimum depth of glazing rabbet shall be 3/4 inches (19.1). Each window shall be pressure equalized to direct water to the exterior through baffled weeps.

C. Glazing Materials: Material compatible with aluminum and those sealants and sealing materials used in composite structure which have direct contact with the sealing gasket. Standard exterior glazing material shall be glazing tapes in accordance with AAMA 806-1. Interior glazing shall be with aluminum glazing beads of the snap-in type and compression wedge of dense elastomer per ASTM C864.

D. Weatherstripping: High quality material capable of meeting environmental exposure and performance requirements.

E. Finish: Exposed surfaces shall be free of scratches and other serious blemishes and receive an Aluminum Anodic Coating for all exposed surfaces .

1. Adjust and control the direction of mechanical finishes specified to achieve the best overall visual effect.

2. Color and Texture Tolerance: Provide uniform color and continuous mechanical texture for all aluminum components. Engineer reserves the right to reject aluminum fabrications at any time because of color or texture variations that exceed the range of variations established by means of range samples approved by Engineer.

3. Anodize all aluminum components specified to receive this finish, whether or not exposed in the finished work.

4. Mechanically finish aluminum by wheel or belt polishing with aluminum oxide grit of 180 to 220 size, using peripheral wheel speed of 6,000 feet per minute; Aluminum Association Designation - M32 Medium Satin Directional Texture.

    a. Hand Rubbed Finish: Where required to complete the work and provide uniform, continuous texture, provide hand rubbed finish to match medium satin directional texture specified in order to even out and blend in satin finishes produced by other means.

5. Provide non-etching chemical cleaning by immersing the aluminum in an inhibited chemical solution, as recommended by the coating applicator, to remove all lard oil, fats, mineral grease and other contamination detrimental to providing specified finishes.

    a. Clean and rinse with water between steps as recommended by the aluminum manufacturer.

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6. Exposed Aluminum Anodic Coating: Provide anodic coatings as specified which do not depend on dyes, organic or inorganic pigments, or impregnation processes to obtain color. Apply coatings using only the alloy, temperature, current density and acid electrolytes to obtain specified colors in compliance with the designation system and requirements of the Aluminum Association. Comply with the following:

7. Provide Architectural Class I high density anodic treatment by immersing the components in a tank containing a solution of 15 percent sulfuric acid at 70 degrees F with 12 amperes per square foot of direct current for minimum of sixty minutes; Aluminum Association Designation AA-M10C21A44 – Dark Bronze to match existing.

8. Provide the following physical properties, as verified by independent laboratory testing procedures, performed by a laboratory acceptable to Engineer, as specified:

9. Anodic Coating Thickness, ASTM B244: 0.7-mils minimum.

10. Anodic Coating Weight, ASTM B137: 32-mg/sq. in. minimum.

11. Resistance to Staining, ASTM B136: No stain after 5 minutes dye solution exposure.

12. Salt Spray, ASTM B117: 30,000 hours exposure with no corrosion or shade change.

13. Anodization Tests: Prepare samples and perform tests on each rack load for ASTM B136 and ASTM B244 compliance, and each production shift for ASTM B137 compliance during the processing, to verify compliance with specified physical properties. Include coupons in each rack load of production material; retain samples and carefully record test date and area of building wall to receive the corresponding materials.

14. Seal finished anodized coatings using deionized boiling water to seal the pores and prevent further absorption.

F. Hardware

1. Hinging hardware shall be heavy-duty stainless steel four bar hinges conforming to AAMA 904.1. Hinges shall have a positive stop and an adjustable friction shoe.

2. Locking hardware, strikes, keepers and pole rings shall be cast white bronze with a clear lacquer finish.

3. All hardware fasteners penetrating frame or inside plane of window shall be factory sealed with resilient non-hardening compound.

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G. Screens: Insect screens shall be constructed with extruded frames, rigidly joined at their corners. Screen cloth shall be 18 x 16 mesh aluminum. Screen frames shall be finished to match aluminum windows. Splines shall be extruded vinyl, removable to permit rescreening screens shall be shipped separate from the window order. Provide wickets as required to provide access to hardware and proper operation of window.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Installation shall be by a manufacturer's authorized installer and in accordance with AMMA specifications and manufacturer's recommendations.

B. Anchor windows in place straight, plumb and level. Installation shall permit the windows to expand and contract horizontally and vertically without buckling or other harmful effects. No frame member shall be allowed to contact the structural lintel or beam over the window opening. Minimum clearance shall be 1/4 inch or as recommended by the manufacturer. Flexible anchors shall be installed to take up deflection. All metal-to-metal joints shall be made tight and properly sealed for weather tightness.

C. Adjust for proper operation after glazing installation is completed. Final adjustment shall be made when project is completed.

END OF SECTION

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SECTION 08 71 00

FINISH HARDWARE

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. The Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all finish hardware work.

2. Extent of finish hardware work is specified and in schedules. Finish hardware is defined to include all items known commercially as finish hardware, as required for swing doors, except special types of unique and non-matching hardware specified in the same Section as the door and door frame.

3. Types of finish hardware work required include, but are not necessarily limited to, the following:

   a. Pivot Hinges

   b. Mortise Locksets.

   c. Panic exit devices.

   d. Cylinders and Keying System

   e. Overhead surface-mounted door closers.

   f. Thresholds.

   g. Floor stops.

   h. Weatherstripping

   i. Miscellaneous items.

   j. Written field report on condition of each item of finish hardware actually present on each door at the project site with each item referenced to approved Shop Drawings. Final approval or final payment shall not be provided to Contractor until field report has been submitted to and approved by the Engineer.

   k. Temporary finish hardware.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the finish hardware.

2. Coordinate the work of other Sections in order to provide clearances and accurate positioning of recessed or cast-in-place items required by this Section.

1.02 RELATED SPECIFICATIONS

A. Section 06 10 00 – Rough Carpentry

B. Section 08 11 19 – Stainless Steel Doors and Frames

C. Section 08 33 00 – Flood-Resistant Doors and Frames

D. Section 08 33 23 – Overhead Coiling Doors

E. Section 08 51 13 – Aluminum Windows and Frames

1.03 REFERENCES

A. Comply with the applicable provisions and recommendations of the following, except where otherwise shown or specified:

1. 1657, Sealing Compound - Single Component, Butly Rubber Based, Solvent Release Type.

1.04 PERFORMANCE CRITERIA

A. Where the finish, shape, size or function of a member receiving finish hardware is such as to prevent the use of or make unsuitable the types specified, furnish similar types having as nearly as practicable the same operation.

B. If finish hardware for any location is not specified, provide finish hardware equal in design and quality to adjacent finish hardware for comparable openings.

C. Furnish finish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements, as necessary for proper installation and function.

D. Unless otherwise specified, comply with DHI, Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames and Recommended Locations for Builders Hardware for Custom Steel Doors and Frames.

E. Provide stainless steel finish hardware or matching finish hardware as specified for all doors and frames.

1.05 SUBMITTALS

A. The Contractor shall submit the following in accordance with the contract comments:

1. Actual unit of each finish hardware item specified incorporating all standard and special features and finishes specified, demonstrated and identified by supplier's representative to the Engineer. Samples shall be presented at time of Shop Drawing submittal as the Engineer will not review or approve Shop Drawings without concurrent sample submissions.

2. Hardware Schedule: Prepare and submit hardware schedule in the following form:

Hardware Item	Quantity	Size	Reference Hardware Set (indicated at end of this section)	Finish	Mfr. Name and Catalog No.	Key Control Symbols	UL Mark (if fire rated and listed)	ANSI/BHMA Finish Designation

3. The Engineer's review will be for general quality and features of units, compliance with all other requirements is the exclusive responsibility of the Contractor.

4. Approved samples may be incorporated into the finish hardware work.

B. Shop Drawings:

1. Copies of manufacturer's data for each item of finish hardware. Include whatever information may be necessary to show compliance with requirements and include instructions for installations and for maintenance of operating parts and exposed finishes. Wherever needed, furnish templates to fabricators of other work which is to receive finish hardware.

2. Copies of the finish hardware schedule. Include a separate key schedule, showing clearly how Owner's final instructions on keying of locks have been fulfilled. Finish hardware schedules are intended for coordination of the work. Review and acceptance by the Engineer does not relieve the Contractor of his exclusive responsibility to fulfill the requirements as shown and specified.

3. Based on the finish hardware requirements specified, organize the final finish hardware schedule into "hardware sets," indicating complete designation of every item required for each door or opening. Furnish initial draft of schedule at the

earliest possible date, in order to facilitate the fabrication of other work (such as stainless steel frames) which may be critical in the Project construction schedule. Furnish final draft of schedule after samples, manufacturer's data sheets, coordination with Shop Drawings for other work, delivery schedules and similar information have been complete and accepted.

4. Copies of manufacturers' specifications and installation instructions for required materials and components which are not included in other submittal specified in other Sections of this Specifications. Coordinate the requirements of this Section with other submittal and coordinate the submittal of other data in other Sections with the Sections' submittal.

5. Maintenance Manual: Upon completion of the work, furnish copies of detailed maintenance manuals, including the following information:

   a. Product name and manufacturer.

   b. Name, address and telephone number of manufacturer and local distributor.

   c. Detailed procedure for routine maintenance and cleaning.

   d. Detailed procedures for repairs such as dents, scratches and staining.

   e. Parts identification manual and maintenance manuals for each piece of finish hardware.

C. Test Reports: Submit for approval certified laboratory test reports for required performance tests.

1.06 QUALITY ASSURANCE

A. Supplier Qualifications: The finish hardware supplier shall have in his employ a member of the Door and Hardware Institute as a certified Architectural Hardware Consultant who shall be responsible for checking, supervising and preparing written Field Report for complete finish hardware installation and with on-site presence during the time of installation and adjustment of the work.

B. Requirements of Regulatory Agencies: Comply with the applicable requirements of governing authorities and codes for the types of finish hardware specified.

C. Source Quality Control: Obtain all similar products and accessories from the same manufacturer.

D. Substitutions

1. Clearly identify, in a manner which is highlighted to the Engineer, all proposed substitutions, modifications, variations, unspecified features and "or approved

equal" products. Provide complete comparative data, comparing "or approved equal" with specified products, at time of Shop Drawings submission.

2. Do not make substitutions after the Engineer's approval of final finish hardware schedule and sample at time of Shop Drawing submission.

1.07 DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:

1. Deliver finish hardware sufficiently in advance of its setting for proper inspection.

2. Pack each piece of finish hardware separately, complete with screws, keying, instructions and templates, tagged to correspond with the approved finish hardware schedule.

3. Deliver individually packaged finish hardware items at the proper time to the proper locations for installation.

B. Storage of Materials:

1. Provide secure lock-up for finish hardware stored at the project site, but not yet installed.

2. Store finish hardware in manufacturers' original packages.

C. Handling of Materials: Control the handling and installation of finish hardware items which are not immediately replaceable, so that the completion of the work will not be delayed by finish hardware losses, both before and after installation.

1.08 PROJECT CONDITIONS

A. Coordinate with other work by furnishing Shop Drawings, inserts, templates and similar items at the appropriate times for proper sequencing of construction without delays.

PART 2 – PRODUCTS

2.01 GENERAL

A. Hand of Door: Contract Drawings show the swing or hand of each door leaf (left, right, reverse bevel, etc.). Furnish each item of finish hardware for proper installation and operation of the door swing as shown.

B. Manufacturer's Nameplate: Do not use manufacturer's products which have manufacturer's name or trade name displayed in a visible location (omit removable nameplates).

C. Base Metals: Produce finish hardware units of the basic metal and forming method specified, using the manufacturer's standard metal alloy, composition, temper and hardness. Do not substitute materials or forming methods for those specified.

D. Fasteners: Manufacture finish hardware to conform to published templates, generally prepared for machine screw installation. Do not provide finish hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.

E. Furnish screws for installation, with each finish hardware item. Provide Phillips flat-head screws except as otherwise specified. Finish exposed (exposed under any condition) screws to match the hardware finish or, if exposed in surfaces on other work, to match the finish of such other work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.

F. Provide fasteners which are compatible with both the unit fastened and the substrate, and which will not cause corrosion or deterioration of finish hardware, base material or fastener.

G. Provide concealed fasteners for finish hardware units which are not exposed when the door is closed, except to the extent no standard manufacturer units of the type specified are available with concealed fasteners. Do not use through bolts for installation when the bolt head or the nut on the opposite face is exposed in other work under any condition, except where it is not possible to adequately reinforce the work and use machine screws or concealed fasteners of another standard type of satisfactorily avoid the use of through bolts.

H. Tools for Maintenance: Furnish a complete set of specialized tools as needed for Owner's continued adjustment, maintenance, removal and replacement of finish hardware.

2.02 HEAVY-DUTY PIVOT HINGES

A. Templates and Screws: Provide only template-produced units.

B. Base Metal: Fabricate hinges from forged bronze with US 26D Satin Chrome finish.

C. Number of Hinges: Provide two hinges on each door leaf of less than 96-inches height; provide one additional hinge for next 30-inches of door height; provide two additional hinges for each 30-inches or fraction thereof for doors above 120-inches tall.

D. Hinge Size: Except as otherwise specified or as required to comply with UL and NFPA, provide hinges of the following sizes:

1. Exterior and Interior Doors, maximum 48-inches wide: Top and bottom pivots; intermediate pivots based on number of hinges as specified; minimum of one intermediate pivot required on all doors.

E. Types of Hinges: Provide all doors with offset hung, bottom, top and intermediate units with hardened steel pivot pins treated to prevent rusting or binding, permanently seated in an oil impregnated sintered bronze bearing lubricated for the life of the door and capable of supporting a minimum door weight of 800 pounds and recommended by the manufacturer for use on heavy-duty high traffic doors subject to extreme abuse. Provide single acting, mortised mounted units sized for a maximum door width of 4 foot-0 inches. Top pivot shall have a sloped top surface.

F. Product and Manufacturer: Provide one of the following:

1. H147 Bottom Pivot, H180 Top Pivot and M190 Heavy-Duty Intermediate Pivots by Rixson, A subsidiary of Yale Security, Incorporated.

2. Or approved equal.

2.03 MORTISE LOCKS SETS

A. Strikes: Provide manufacturer's standard wrought box strike, for each location and use shown. Provide stainless steel curved lip strikes, unless otherwise recommended by manufacturer, finish to match lock or latch set trim.

B. Lock Throw: Provide minimum of 3/4-inch anti-friction latch bolt and 3/4-inch dead bolt throw wherever available on manufacturer's functions specified.

C. Function: Classroom

D. Materials: Provide the following materials:

1. Latch Bolt: Stainless steel.

2. Dead Bolt: Stainless steel.

3. Case: Stainless steel.

4. Hub: Nickel steel.

5. Scalp: Stainless steel.

6. Escutcheon: 8-1/2-inches by 1-3/4-inches stainless steel; US 32D; Satin Stainless Steel.

7. Backset: Provide minimum backset of 2-3/4-inches.

8. Finish: US32D Satin Stainless Steel.

9. Product and Manufacturer: Provide one of the following:

a. Heavy-Duty Mortise Lockset 8200- J Lever set by Sargent

b. Schlage L Series with 03 Lever set;

c. Or approved equal.

2.04 PANIC EXIT DEVICES

A. Strikes: Provide concealed vertical wrought stainless steel rim-mounted top latch bolt and bottom latch bolt for each location and use shown. Provide all hardware required for conditions where transom panels are indicated.

B. Exit device dogging: All exterior doors with exist devices shall be equipped with a keyed dogging device to hold the push bar down and the latch bolt in the open position. The outside trim is to be night latch function. EXCEPTION: fire rated doors and electric dogging

C. Exit Doors: Where required by governing regulations or where shown or scheduled, provide panic exit devices of the type required. Provide units for 1-3/4-inch thick doors.

D. Lock Throws: Provide minimum of 3/4-inch latch bolt throws.

E. Provide mortise latching exit devices as specified.

F. Provide the following materials:

1. Latch Bolt: Stainless steel.

2. Case: Stainless steel.

3. Cylinders: Brass.

4. Front: Stainless steel.

5. Chassis: Brass.

6. Nightlatch Escutcheon Pull Trim

G. Backset: Provide minimum backset of 2-3/4-inches.

H. Finish: US 32D Stainless Steel.

I. Function: ANSI No. 4: entrance by trim when latch bolt is retracted by key or set in a retracted position by key; no thumbpiece.

J. Product and Manufacturer: Provide one of the following:

1. Corbin Russwin ED5200 x P957ET Panic Rim Exit Device with Nightlatch Escutcheon Pull TrimOr approved equal.

2.05 CYLINDERS AND KEYING SYSTEM

A. Provide a great grandmaster keying system. Keying system are to be on a Schlage Everest or Sargent Restricted system. Keyed to the Owners Master Key System

B. Equip all locks with manufacturer's special 6-pin tumbler cylinder, with construction master key feature, which permits voiding of construction keys without cylinder removal. Provide temporary construction lock cylinder keying for securing areas during construction as directed by the Engineer for a period of up to the final acceptance of the Project.

C. Key Material: Provide keys of nickel silver only.

D. Key Quantity: Furnish 3 keys for each lock and 5 keys for each master and grandmaster system. Provide one extra key blank for each lock. All keys are to be shipped directly to the County Locksmith Department.

E. Provide all Finish Hardware, keyed to keying system to doors specified in Section 08 11 19 – Stainless Steel Doors and Frames, Section 08 33 00 – Flood Resistant Doors and Frames, and Section 08 33 23 – Overhead Coiling Doors. Provide lock cylinder keyed to keying system as work of this Section.

2.06 OVERHEAD SURFACE-MOUNTED DOOR CLOSERS

A. Provide all doors, unless specially scheduled or specified as being provided with floor mounted or concealed overhead closers, with surface-mounted overhead door closers. Provide both active and inactive door leafs with closers.

B. Size of Units: Except as otherwise specified, comply with the manufacturer's recommendations for size of door control unit, depending upon size of door, exposure to weather, and anticipated frequency of use.

C. Where parallel arms are specified, and for closers on exterior doors, provide closer unit one size larger than recommended for use with standard arms.

D. Use parallel arm arrangement for doors that would otherwise have the door closer appearing in finished corridors or entries.

E. Comply with UL, Building Materials Directory, and List of Inspected Fire Protection Equipment and Materials, and NFPA No. 80 for doors requiring door closers. Modify closers specified as required.

F. Provide hold open feature for all non-fire rated doors unless otherwise specified.

G. Provide corner bracket mounting on exterior doors. Select all arms to clear weatherstripping, and overhead door holders.

H. Provide long arm to allow door to swing 180 degrees where long arm will eliminate floor mounted stops.

I. Provide closers with spring power adjustment feature capable of increasing spring power 15 percent minimum in all closer sizes.

J. Provide individual regulating valves for closing and latching speeds, and separate adjustable backcheck valve.

K. Provide delayed closing action feature on all door closers. Position valve at top of closure.

L. Provide the following materials and features in addition to others specified herein:

1. Full Metal Cover: Aluminum.

2. Case: Cast iron.

3. Arms: Plated to match full metal covers.

4. Other Parts: Steel.

5. Extreme temperature fluid.

6. Security torx machine screws.

7. Ten year warranty.

8. Provide manufacturer's optional corrosion protection.

M. Finishes: S26D Satin Chrome. Color coordinate all arms and other accessories.

N. S26D Satin Chrome. Color coordinate all arms and other accessories.

O. Highly Corrosive Atmospheres: Provide with all closers.

P. Product and Manufacturers: Provide one of the following:

1. 8501 Series with Unitrol Parallel Arm by Norton, A Subsidiary of Assa Abloy.

2. Or approved equal.

2.07 FLOOR STOPS

A. Provide modern cylindrical style, satin stainless steel US32D finish, Ansi/BHMA 630 Floor stops at all doors at positions to avoid tripping hazards.

B. Rubber Bumper ring in grey polymer.

C. Size: base diameter 1-1/4inch, by 1 ½-inch high.

D. Floor stops shall be as manufactured by:

1. Rockwood model 446 A Subsidiary of Assa Abloy.

2. Or approved equal.

2.08 DUST-PROOF STRIKES

A. Provide brass dust-proof strikes which incorporate a slotted plunger raised to flush position by spring tension for all flush bolts.

B. Provide 5/8-inch inside diameter dust-proof strikes; threshold mounted and surface mounted.

C. Finish: B.H.M.A. 610, US 7 Satin brass, blackened, bright relieved, clear coated.

D. Product and Manufacturer: Provide one of the following:

1. DP-1 and DP-2 by Ives Part of Worldwide Ingersoll-Rand.

2. Or approved equal.

2.09 THRESHOLDS

A. Thresholds for all exterior doors shall be thermally broken. All interior doors shall be non-thermally broken thresholds.

1. Metal: Extruded aluminum; custom satin brushed aluminum; US 26 finish.

2. Surface Pattern: Fluted tread, manufacturer's standard.

3. Provide countersunk stainless steel screws and expansion shields.

4. Width: Five (5)-inches wide and of length sufficient to span full width of rough openings; coped and scribed neatly at and around door frames.

5. Construction:

a. Two piece thermally broken with PVC break, complying with manufacturer's recommendations.

b. Single-piece, non-thermally broken complying with manufacturer's recommendations.

6. Profile: Provide manufacturer's unit which conforms to the minimum size and profile requirements specified.

7. Thickness: 0.135 inch minimum.

B. Thresholds shall be manufactured by the following:

1. 525 (thermally broken), 655 (non-thermally broken) by Zero International, Inc., an Allegion, PLC. 85 Mushroom Blvd, Rochester, NY.

Or approved equal.

2.10 WEATHERSTRIPPING

A. Provide bumper-type weatherstripping at jambs and head, including a resilient insert and metal retainer strip, surface-applied of the following metal, finish and resilient bumper material:

1. Housing: Extruded aluminum with dark anodized finish; 0.062-inch minimum thickness of main walls and flanges.

2. Dimensions: 1-1/2 inches by 15/16-inches; stop-mounted.

3. Seals: Closed-cell extruded sponge neoprene.

4. Product and Manufacturer: Provide one of the following:

a. No. 472AA by Zero Manufacturing Company, an Allegion, PLC. 85 Mushroom Blvd, Rochester, NY.

b. Or approved equal.

2.11 THRESHOLDS

A. Thresholds for all exterior doors shall be supplied by custom entry door system manufacturer. All interior doors shall be provided with thresholds.

B. Metal: diamond plate Stainless steel .250-inch thick/

C. Surface Pattern: diamond plate with non-slop epoxy abrasive photo luminescent particles bonded to surface.

D. Provide countersunk stainless steel screws and beveled edges.

E. Width: 5-inches wide and of length sufficient to span full width of rough openings; coped and scribed neatly at and around door frames.

F. Construction:

1. Single-piece, complying with manufacturer's recommendations.

G. Profile: Provide manufacturer's unit which conforms to the minimum size and profile requirements specified.

H. Coordinate thresholds for full compatibility with recessed floor mounted closers.

I. Thickness: 1/2 inch minimum.

J. Product and Manufacturer: Provide one of the following:

1. Custom Order #669 DP-STST-EL Stainless Steel as manufactured by Zero. Refer to contract drawing for profile.

2. Or approved equal.

2.12 SEALANTS

A. Provide butyl rubber sealant complying with FS TT-S-001657 for use with thresholds.

2.13 HARDWARE FINISHES

A. Provide matching finishes for hardware units at each door or opening, to the greatest extent possible. Reduce difference in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of finish hardware exposed at the same door or opening. In general, match all items to the manufacturer's standard finish for the latch set for color and texture.

PART 3 – EXECUTION

3.01 INSPECTION

A. The Contractor, installer and architectural hardware consultant shall examine the substrate to receive finish hardware, and ascertain the conditions under which the work will be performed, and notify Engineer in writing of unsatisfactory conditions. Do not proceed with the finish hardware work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.

3.02 PREPARATION

A. Templates: Furnish finish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of finish hardware. Upon request, check the Shop Drawings of such other work, to confirm that adequate provisions are made for the proper installation of the finish hardware.

3.03 INSTALLATION

A. Mount finish hardware units at heights recommended in "Recommended Locations for Builders' Hardware" by National Builders Hardware Association, except as otherwise specified or required to comply with governing regulations.

B. Install each finish hardware item in compliance with the manufacturer's instructions and recommendations.

C. Set units level, plumb and true to line and locations. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

D. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

E. Cut and fit threshold and floor covers to profile of door frames, and recessed floor mounted closers with mitered corners and hair-line joints. Join units with concealed welds or concealed mechanical joints. Cut smooth openings for spindles, bolts and similar items, if any.

F. Screw thresholds to substrate with No. 10 or larger stainless steel screws of the proper type for permanent anchorage.

G. Set thresholds in a bead of butyl rubber sealant to completely fill concealed voids and exclude moisture from every source. Do not plug drainage holes or block weeps. Remove excess sealant before sealant cures to a firm set.

3.04 FIELD QUALITY CONTROL

A. Provide a written field report, prepared by installer’s architectural hardware consultant, identifying actual condition, location, manufacturer, and product designation for each item of finish hardware actually present on each door at the Site, including whether finish hardware is adjusted and operating properly. Compare actual units present with each item referenced to approved Working Drawings and Contract requirements.

B. Installer’s architectural finish hardware consultant shall provide opinions to, and assist the Engineer in determining, acceptability of installation as work proceeds. All comments and discussions, conversations and meetings with the Engineer shall be

included in written field report for submission to the Engineer for review and approval at completion of finish hardware installation.

C. As part of written field report to be submitted to the Engineer for approval, recommend remedial actions for work not in compliance with the Specifications. No payment for work shall be made until remedial recommendations and actions have been approved by the Engineer and incorporated into the work.

3.05 ADJUSTMENT AND CLEANING

A. Provide a Final Report on the actual finish hardware present on each door of the work. Compare this field Report to approved Shop Drawings submittal and present to the Engineer with remedial recommendations. No payment for work shall be make until remedial recommendations have been approved by the Engineer and implemented by the Contractor.

B. Adjust and check each operating item of finish hardware and each door to ensure proper operation or function of every unit. Lubricate moving parts with the type lubrication recommended by manufacturer (graphite-type if no other recommended). Replace units which cannot be adjusted and lubricated to operate freely and smoothly as intended for the application.

C. Final Adjustment: Where finish hardware installation is made more than one month prior to Final Acceptance or occupancy of a space or area, return to the work during the week prior to Final Acceptance or occupancy, and make a final check and adjustment of all finish hardware items in such space or area. Clean and relubricate operating items as necessary to restore proper function and finish of finish hardware and doors. Adjust door control devices to compensate for final operating of heating and ventilating equipment.

D. Provide each manufacturer’s authorized technical representative to instruct and train the Owner's personnel in proper adjustment and maintenance of finish hardware during the final adjustment of finish hardware.

E. Finish hardware which is blemished or defective will be rejected even though it was set in place before defects were discovered. Remove and replace with new finish hardware. Repair all resultant damage to other work.

F. Continued Maintenance Service: Approximately 6 months after the acceptance of finish hardware in each area, the installer, accompanied by the representative of the latch and lock manufacturer, shall return to the project and readjust every item of hardware to restore proper function of doors and finish hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedure. Clean and lubricate operational items wherever required. Replace finish hardware items which have deteriorated or failed due to faulty design, materials or installation of finish hardware

units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the finish hardware.

3.06 SCHEDULES

A. Scheduled items for each door are generic and rely on information specified above. The listing of hardware types provided is only a general guideline for the final finish hardware schedule. The Contractor shall submit a finish hardware schedule acceptable to all codes and testing agencies.

B. Finish Hardware Schedule:

1. HDW SET 1 (EXTERIOR, NO UL LABEL)

    a. Pivot Hinge

    b. Cylinder and Keying System

    c. Mortise Lockset

    d. Panic Exit Device

    e. Over Head Surface-Mounted Door Closer

    f. Threshold

    g. Weatherstripping

2. HDW SET 2 (INTERIOR, FLOOD DOOR)

    a. Cylinder and Keying System work of this section. All other finish hardware to be as indicated, provided in coordination with Section 08 33 00 – Flood-Resistant Doors and Frames.

END OF SECTION

SECTION 08 80 00

GLASS AND GLAZING

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Furnish all labor, materials, equipment, and appliances required for the complete execution of Work as shown on the Contract Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 08 11 19 – Stainless Steel Doors and Frames

B. Section 08 51 13 – Aluminum Windows and Frames

1.03 REFERENCE

A. All work shall comply with the New York State Building Code.

B. Without limiting the requirements of this Section, the Work shall conform to the applicable requirements of latest versions of the following:

1. ASTM – American Society for Testing and Materials

    a. ASTM C1036 – Standard Specification for Flat Glass

    b. ASTM C1048 – Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass

    c. ASTM E2190 – Standard Specification for Insulating Glass Unit Performance and Evaluation

    d. ASTM E2188 – Standard Test Method for Insulating Glass Unit Performance

2. ANSI – American National Standards Institute

    a. ANSI Z97.1 – Safety Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings

3. Underwriters' Laboratories (UL) Building Materials Directory

4. Consumer Product Safety Commission (CPSC) 16 CFR1201 – Safety Standard for Architectural Glazing Materials

5. National Fire Protection Association (NFPA)

6. National Glass Association (NGA) Glass Association of North America (GANA) Glazing Manual

1.04 SUBMITTALS

A. In accordance with the procedures and requirements set forth in Section 01 33 00 – Submittal Procedures, submit the following:

1. Sample of each type of glass and color chart.

2. Complete layout and installation drawings and schedules with clearly marked dimensions.

3. Manufacturer's technical descriptions and reports for glass and glazing.

1.05 JOB CONDITIONS

A. Check openings to verify that frames are plumb and true, square, and secure.

B. Take field dimensions for cutting glass and fabricating units.

C. Do not install glazing when the ambient temperature is less than 50 degrees F.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in the manufacturer's original unopened labeled containers, clearly marked with their name and brand. Transport large panes of glass in vertical position with spacers to prevent contact between panes and edges.

B. Store glass in a dry, well-ventilated location at a constant temperature, maintained above dew point. Handling shall be kept to a minimum. Protect glass from soiling, condensation, or moisture of any kind.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with this Section, provide products manufactured by one of the following:

1. Vitro;

2. Viracon;

3. Guardian;

4. Libby – Owens – Ford;

5. Cardinal IG;

6. Or approved equal.

2.02 MATERIALS

A. Insulated Glass:

1. Exterior glass panel shall meet the requirements of ASTM C1036. Heat treated glass shall meet the requirements of ASTM C1048.

2. Clear Float Glass Ply- Type I, Class 1, Quality g3.

B. Insulating glass (unit type 1) shall be nominally 1.063 inch thick hermetically sealed units located at all exterior glazed openings in accordance with consisting of the following:

1. Outboard Lite 9/16-inch Laminated

a. Outer Plys: 1/8-inch each ply

b. Interlayer: 0.060-inch Clear PVB

2. Air Space 3/8-inch Spacer (air filled)

3. Inter Ply: 1/8-inch PPG Solarban 60 on Clear Low-E #4

a. Inboard Lite: 1/4-inch Clear Laminated

b. Interlayer: 0.030-inch Saflex Clear PVB

4. Transmittance:

a. Visible Light: 41%

b. Solar Energy: 17%

5. Ultraviolet: <1% Ultraviolet defined as 300 to 380 nanometers (nm)

6. Reflectance:

a. Visible Light Exterior: 7%

b. Visible Light Interior: 10%

7. Solar Energy: 6%

8. ASHRAE U-Value:

a. Winter Nighttime: 0.31 Btu/hr-ft2- °F

b. Summer Daytime: 0.32 Btu/hr-ft2- °F

9. Shading Coefficient: 0.30

10. Solar Heat Gain Coefficient (SHGC): 0.26

a. Relative Heat Gain: 59 Btu/hr-ft2- °F

b. Light to Soar Gain 1.59

C. Tempered Glass:

1. Tempered glass shall be plate or float glass tempered by a special heat process and 1/4-inch thick or as noted on Contract Drawings.

2. Tempered glass shall meet the requirements of ANSI Z97.1 and CPSC 16 CFR 1201.

3. Tempered glass shall be used for glazed panels at all door applications, unless otherwise noted. Refer to Section 08 11 19 – Stainless Steel Doors and Frames for work related to this specification.

D. Insulating Glass:

1. Insulating glass shall be Low-E preassembled units of glass enclosing a hermetically sealed dehydrated air space and certified through the Insulating Glass Certification Council (IGCC) in accordance with ASTM E2190 and E2188.

2. Insulating glass shall be made from heat-strengthened glass.

a. Sealing system shall consist of metal spacer with bent or soldered corners, butyl primary and silicone secondary seal.

b. Desiccant shall be manufacturer's standard.

c. Exterior glass shall be insulated.

E. Provide glass fire rated tested for fire rated assembly (doors, windows, or walls) shown on the Contract Drawings in accordance with UL and NFPA requirements. Provide glass that additionally meets the requirements of ANSI Z97.1 and CPSC 16CFR1201 (Cat 1 and II). Glass shall be premium grade ground and polished both sides. Permanently label each piece of glass.

F. Opaque panels shall utilize insulating glass construction, both lights shall be heat strengthened. Tinting to match glass color and shall be applied to the #2 surface and an opaque ceramic frit to the #3 surface.

G. Glazing materials shall be a resilient, non-hardening glazing compound of either polysulfide or a silicone type. Materials shall not contain any solvents and shall be 100% solids. Oil base putty shall not be used. Glazing compounds shall not be thinned with chlorinated solvents or benzene related compounds. Glazing tape may be used where, and as recommended by the manufacturer. The color of all exposed glazing materials shall harmonize with the window units.

H. Setting blocks and spacer shims shall be a nonstaining material as recommended by the glass manufacturer.

PART 3 – EXECUTION

3.01 GENERAL

A. Determine glass sizes by measuring the frames to receive the glass at the site. Comply with t Section 08 51 13 – Aluminum Windows and Frames, Section 08 11 19 – Stainless Steel Doors and Frames and manufacturer's specified tolerances for each type of glass including cutting tolerance, minimum edge clearance, minimum face clearance, and cover on glass.

B. The edges of all tempered and insulating glass shall be protected from damage and edges shall not be modified in any way after the glass leaves the factory. Nipping of any glass to reduce size shall not be permitted.

C. Deliver glass with the manufacturer's labels showing type, thickness, and quality of material (and U.L. label as required). These labels shall not be removed until the glass is set, and final approval has been secured.

3.02 INSTALLATION

A. Sheet glass shall be cut and set with waves running horizontally.

B. All glass shall be set in such manner as to avoid possibility of breakage.

C. Rabbets shall be thoroughly cleaned and shall have been prime coated before glass is set.

D. Glass shall be well bedded and back glazed, and all surplus compound and markings shall be carefully removed from doors, sash, and adjoining work, while still fresh. Compound shall be finished in true, even lines, neatly and smooth faced. Set glass in strict accordance with the manufacturer's printed directions.

E. All glass when set and glazed shall be free from rattle and be watertight.

F. Glazing molds shall be removed and replaced in their correct locations in such a manner as not to mar molding or the screws securing same.

G. Install fire rated glass in strict accordance with manufacturer's requirements to meet fire rated assembly shown on the Contract Drawings.

3.03 PROTECTION AND CLEANING

A. Before and after installation, all work shall be properly protected against damage.

B. On completion and prior to turning the project over to the Owner, all metal work and glass shall be cleaned and left in perfect condition. Glass shall be washed outside and inside.

END OF SECTION

SECTION 08 95 43

FLOOD VENTS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment and appliances required for the complete execution of Work shown on Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 04 21 13 - Brick Masonry

B. Section 04 22 23.23 - Prefaced Concrete Unit Masonry

C. Section 06 10 00 – Rough Carpentry

D. Section 07 60 00 - Sheet Metal Flashing and Trim

E. Section 07 90 00 – Joint Fillers, Sealants and Caulking

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of these specifications Work shall conform to the applicable requirements of the following documents:

1. ASCE/SEI 24-98, Flood Resistant Design and Construction.

2. ASCE/SEI 24-05, Flood Resistant Design and Construction.

3. ASCE/SEI 24-14, Flood Resistant Design and Construction.

4. FEMA, 44-CFR, Part 59-60 and 60.3 National Flood Insurance Program (NFIP).

5. FEMA TB 1-2008, Openings in Foundation Walls and Walls of Enclosures for Buildings Located in Special Flood Hazard Areas.

6. FEMA TB 2-2008, Flood Damage-Resistant Materials Requirements.

7. NER-624, National Evaluation Report No. NER-624, July 2007.

8. International Code Council ICC-ES Acceptance Criteria for Automatic Foundation Flood Vents (AC-364), October 2007.

9. International Code Council ICC-ES Acceptance Criteria for Mechanically Operated Flood Vents (AC-364), October 2013.

10. UL - Test for Fire Dampers in conjunction with flood vents.

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1.04 SUBMITTALS

A. In accordance with the procedures and requirements set forth in Section 01 33 00 – Submittal Procedures, submit the following:

1. Manufacturers literature and installation instructions.

2. Samples, of each material listed.

3. Provide shop drawings for the full extent of each item to be provided. Provide overall plans and details of each transition. Provide details of each item.

4. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in factory packed unopened cartons and crating bearing the manufacturer's labels.

B. Store materials in clean, dry protected area in such manner to preclude damage of any nature.

C. Handle all materials with proper care to avoid denting, marring, warping or other distortions during delivery, storage and handling.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Smart Vent Products, Inc., 19 Mantua Road Mount Royal NJ 08061; Tel: 877-441-8368; Email: info@smartvent.com; Web: www.smartvent.com

B. Or approved equal.

2.02 FLOOD VENTS

A. General: Vents are constructed of Marine Grade 316 Stainless Steel formed and smooth- welded with a rigid construction. Frames are designed for installation in masonry, concrete, or framed walls, stud walls, garage doors and metal panels. Vents have a pivoting door assembly that is fitted with two patented sealed floats that provide vermin protection and immediately and automatically release the door upon contact with rising water to relieve unbalanced lateral forces on foundation walls. All flood vents are required to work bi- directionally, without human intervention.

B. Insulated Series: Provide flood protection only. Insulated Core with perimeter weather-stripping.

1. SINGLE FLOOD VENT - Basis of design - Model #1540-520: Insulated Door.
    a. Flood Coverage: 200 sq. ft.
    b. Insulated Core R-Value: 8.34
    c. Size: 16 inches W by 8 inches H.
    d. Rough Opening: 16-1/4 inches W by 8-1/4 inches H.
2. STACKED FLOOD VENT - Basis of design - Model #1540-521 Stacking Model: Insulated Doors.
    a. Flood Coverage: 400 sq. ft.
    b. Insulated core R-Value: 8.34
    c. Size: 16 inches W by 16 inches H.
    d. Rough Opening: 16-1/4 inches W by 16-3/8 inches H.

C. Accessories:

1. Installation Clips, four for each vent, with the exception for Wood Wall, Overhead Door, and Multi-frame models.
2. Sealant: HurriBond or approved equivalent adhesive for masonry or concrete surfaces.
3. Adjustable wrench for thru-bolted models and screwdriver for stud wall models.
4. Trim and Sleeves: Sleeves for use in ' un-filled' masonry and for, Fire Walls where ' air- space' is required on Exterior Walls and to finish off the inside of openings:
    a. Adjustable Sleeve/Trim #1540-531-12: 8 inches to12 inches.
    b. Adjustable Sleeve/Trim #1540-531-15: 12 inches to15 inches.

D. Powder-Coat Finish with color as follows:

a. Custom: color selected by engineer from manufacture’s standard powder coating finish colors:
    1) Black
    2) White
    3) Gray

4) Wheat

E. Insulated Sealing Kit:

1. SINGLE FLOOD VENT - Flood Vent Sealing Kit Model #1540-526 or approved equivalent to provide tight seal behind the vent opening – must be used in conjunction with SMART VENT Insulated Model #1540- 520 or approved equivalent.

2. STACKED FLOOD VENT - Flood Vent Sealing Kit Model #1540-526-2 or approved equivalent to provide tight seal behind the vent opening – must be used in conjunction with SMART VENT Insulated Model #1540- 521 or approved equivalent.

    a. When a flood event occurs, the pre-cut Homasote® or approved equivalent sealing material dislodges from the frame, creating an unobstructed opening to allow flood water to flow through freely.

    b. Installed on the interior wall.

    c. Finish: to match manufacture's standard powder coating finish colors as indicated above.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Verify vent locations are ready to receive work, and dimensions are as indicated on shop drawings or as instructed by manufacturers.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Review and coordinate setting drawings, templates, and related items that are to be embedded in concrete and masonry.

C. Verify that no obstructions exist that will interfere with the proper operation of the vents.

D. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install vents in at least two different walls spaced evenly around foundation perimeter and located a maximum of 12 inches higher than the, interior or exterior grade, to the bottom of vent.

C. Install vents plumb, level, square, true to line, and rigid.

D. Attach vents securely in place using fasteners supplied or approved by manufacturer.

E. Separate incompatible materials to prevent galvanic corrosion.

F. Install one single height flood vent for every 200 sq. ft. of enclosed space below floodplain as indicated on contract drawings.

G. Install one double height flood vent for every 400 sq. ft. of enclosed space below floodplain as indicated on contract drawings.

H. Adjust flood vents for proper operation.

3.04 PROTECTION

A. Protect installed products until completion of project.

Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 09 90 00

PAINTING

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Furnish labor, materials, equipment and appliances required for complete execution of Work shown on Drawings and Specified herein.

B. Section Includes:

1. Paint Materials
2. Shop Painting
3. Field Painting
    a. Surface Preparation
    b. Piping and Equipment Identification
    c. Schedule of Colors
    d. Work in Confined Spaces
    e. OSHA Safety Colors
4. Tables:
    a. Table 1 Painting Schedule
    b. Table 2 Product Listing

C. Related Sections:

1. Section 04 05 19 – Masonry Anchorage and Reinforcing
2. Section 07 26 16 – Below-Grade Vapor Retarders
3. Section 07 90 00 – Joint Fillers, Sealants, and Caulking
4. Section 40 05 97 – Piping and Equipment Identification Systems

1.02 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of these specifications, the Work shall conform to the applicable requirements of the following documents:

1. SSPC – The Society for Protective Coatings Standards
    a. SSPC-Vis 1 – Pictorial Surface Preparation Standards for Painting Steel Structures
    b. SSPC-SP2 – Hand Tool Cleaning
    c. SSPC-SP3 – Power Tool Cleaning
    d. SSPC-SP5/NACE 1 – White Metal Blast Cleaning
    e. SSPC-SP6/NACE 3 – Commercial Blast Cleaning
    f. SSPC-SP7/NACE 4 – Brush-off Blast Cleaning
    g. SSPC-SP10/NACE 2 – Near-White Metal Blast
    h. SSPC-SP11 – Power Tool Cleaning to Bare Metal
    i. SSPC-SP13/NACE6 – Surface Preparation of Concrete
2. ICRI – International Concrete Repair Institute
3. NACE – National Association of Corrosion Engineers
4. NAFP – The National Association of Pipe Fabricators
5. ASTM D1737 – Test Method for Elongation of Attached Organic Coatings with Cylindrical Mandrel Apparatus
6. ASTM B117 – Method of Salt Spray (Fog) Testing
7. ASTM D4060 – Test Method for Abrasion Resistance of Organic Coating by the Taber Abraser
8. ASTM D3359 – Method for Measuring Adhesion by Tape Test

1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in Section 01 33 00 – Submittal Procedures, submit the following:

1. Manufacturer's literature and Material Safety Data Sheets for each product.
2. Painting schedule identifying surface preparation and paint systems proposed. Cross reference with Tables 1 and 2. Provide the name of the paint manufacturer, and name, address, and telephone number of manufacturer's representative who will inspect the work. Submit schedule for approval as soon as possible following

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the Award of Contract, so approved schedule may be used to identify colors and specify shop paint systems for fabricated items. Manufacturer shall substitute paint system with equal performance where required for VOC compliance.

3. Contractor shall submit Q.C. Inspection plan describing all tests and inspections task to be performed. Include copy of daily log showing environmental conditions measurements and frequency. Copy of completed log shall be provided at completion of work.

1.04 SYSTEM DESCRIPTION

A. Work shall include surface preparation, paint application, inspection of painted surfaces and corrective action required, protection of adjacent surfaces, cleanup and appurtenant work required for the proper painting of all surfaces to be painted. Surfaces to be painted are designated within the Painting Schedule and may include new and existing piping, miscellaneous metals, equipment, buildings, exterior fiberglass, exposed electrical conduit and appurtenances.

B. Perform Work in strict accordance with manufacturer's published recommendations and instructions, unless the Engineer stipulates that deviations will be for the benefit of the project.

C. Paint surfaces which are customarily painted, whether indicated to be painted or not, with painting system applied to similar surfaces, areas and environments, and as approved by Engineer.

D. Submerged ferrous metal, piping, and internal pump surfaces within potable water facilities or potable water distribution systems shall be painted with NSF 61/600 approved coatings.

E. Piping and equipment shall receive color coding and identification. Equipment shall be the same color as the piping system.

1.05 QUALITY ASSURANCE

A. Painting operations shall be accomplished by skilled craftsman and licensed by the New York State to perform painting work.

B. Provide a letter indicating that the painting applicator has five years of experience, and 5 references which show previously successful application of the specified or comparable painting systems. Include the name, address, and the telephone number for the Owner of each installation for which the painting applicator provided services.

C. Contractor shall coordinate Q.C Inspections.

D. Notify Owner and Engineer at completion of surface preparation, priming application and final cure to allow inspection by Owner and Engineer or their Third-Party Inspector.

1.06 STORAGE AND DELIVERY

A. Bring materials to the job site in the original sealed and labeled containers.

B. Container label to include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Store paint materials at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

PART 2 – MATERIALS

2.01 GENERAL INFORMATION

A. The term "paint" is defined as both paints and coatings including emulsions, enamels, stains, varnishes, sealers, and other coatings whether organic or inorganic and whether used as prime, intermediate, or finish coats.

B. Purchase paint from an approved manufacturer. Manufacturer shall assign a representative to inspect application of their product both in the shop and field. The manufacturer's representative shall submit a report to the Engineer at the completion the Work identifying products used and verifying that surfaces were properly prepared, products were properly applied, and the paint systems were proper for the exposure and service.

C. Provide primers and intermediate coats produced by same manufacturer as finish coat. Use only thinners approved by paint manufacturer, and only within manufacturer's recommended limits.

D. Ensure compatibility of total paint system for each substrate. Test shop primed equipment delivered to the site for compatibility with final paint system. Provide an acceptable barrier coat or totally remove shop applied paint system when incompatible with system specified, and repaint with specified paint system.

E. Use painting materials suitable for the intended use and recommended by paint manufacturer for the intended use.

F. Require that personnel perform work in strict accordance with the latest requirements of OSHA Safety and Health Standards for construction. Meet or exceed requirements of regulatory agencies having jurisdiction and the manufacturer's published instructions and recommendations. Maintain a copy of all Material Safety Data Sheets at the job site of each product being used prior to commencement of work. Provide and require that personnel use protective and safety equipment in or about the project site. Provide

respiratory devices, eye and face protection, ventilation, ear protection, illumination and other safety devices required to provide a safe work environment.

2.02 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Specifications, provide products from one of the following manufacturers:

1. Tnemec Company Inc.;
2. PPG;
3. CARBOLINE;
4. Sherwin-Williams;
5. International Paints (Akzo Nobel);
6. Or approved equal.

PART 3 – EXECUTION

3.01 SHOP PAINTING

A. Shop prime fabricated steel and equipment with at least one shop coat of prime paint compatible with finish paint system specified. Prepare surface to be shop painted in strict accordance with paint manufacturer's recommendations and as specified. Finish coats may be shop applied, if approved by the Engineer. Package, store and protect shop painted items until they are incorporated into Work. Repair painted surfaces damaged during handling, transporting, storage, or installation to provide a painting system equal to the original painting received at the shop.

B. Identify surface preparation and shop paints on Shop Drawings. Verify compatibility with field applied paints.

C. Coordinate shop painting and field coating to ensure item is delivered and field coating occurs within recoat window of shop painted system requirements.

3.02 SURFACE PREPARATION

A. General

1. Surfaces to be painted shall be clean and dry, and free of dust, rust, scale, and foreign matter. No solvent cleaning, power or hand tool cleaning shall be permitted unless approved by the Engineer.

2. Protect or remove, during painting operations, hardware, accessories, machined surfaces, nameplates, lighting fixtures, and similar items not intended to be painted prior to cleaning and painting. Reposition items removed upon completion of painting operations.

3. Examine surfaces to be coated to determine that surfaces are suitable for specified surface preparation and painting. Report to Engineer surfaces found to be unsuitable in writing. Do not start surface preparation until unsuitable surfaces have been corrected. Starting surface preparation precludes subsequent claim that such surfaces were unsuitable for the specified surface preparation or painting.

4. Surface preparation shall be in accordance with specifications and manufacturer's recommendations. Provide additional surface preparation, and fill coats where manufacturer recommends additional surface preparation, in addition to requirements of specification.

5. Touch-up shop or field applied coatings damaged by surface preparation or any other activity, with the same shop or field applied coating; even to the extent of applying an entire coat when required to correct damage prior to application of the next coating. Touchup coats are in addition to the specified applied systems, and not considered a field coat.

6. Protect motors and other equipment during blasting operation to ensure blasting material is not blown into motors or other equipment. Inspect motors and other equipment after blasting operations and certify that no damage occurred, or where damage occurred, the proper remedial action was taken.

7. Field paint shop painted equipment in compliance with Color Coding and as approved by Engineer.

B. Metal Surface Preparation

1. Prepare all welds to a minimum NACE weld preparation level “C” per NACE Standard SP0178. Provide additional weld preparation where required by the coating manufacturer. Contractor shall provide NACE SP0178 weld mold visual aids on site for evaluation of all weld preparation.

2. Conform to current The Society for Protective Coatings Standards (SSPC) Specifications for metal surface preparation. Use SSPC-Vis-1 pictorial standards or NACE visual standards TM-01-70 or TM-01-75 to determine cleanliness of abrasive blast cleaned steel.

3. Perform blast cleaning operations for metal when following conditions exist:

   a. Moisture is not present on the surface.

b. Relative humidity is below 80%.

c. Ambient and surface temperatures are 5°F or greater than the dew point temperature.

d. Painting or drying of paint is not being performed in the area.

e. Equipment is in good operating condition.

f. Proper ventilation, illumination, and other safety procedures and equipment are being provided and followed.

4. Abrasive blast ferrous metals to be shop primed, or component mechanical equipment in accordance with SSPC-SP5, White Metal Blast.

5. Abrasive blast field prepared ferrous metals in accordance with SSPC-SP10, Near White Metal Blast, where metal is to be submerged, in a corrosive environment, or in severe service. Provide a 3.0 mil minimum angular anchor profile unless recommended otherwise by the coating manufacturer in writing.

6. Abrasive blast field prepared ferrous metals in accordance with SSPC-SP6 Commercial Blast, where metal is to be used in mild or moderate service, or non-corrosive environment or weathering exposure. Provide a 1.5 mil minimum angular anchor profile unless recommended otherwise by the coating manufacturer in writing.

7. Clean nonferrous metals, copper, or galvanized metal surfaces in accordance to SSPC-SP1, Solvent Cleaning, or give one coat of metal passivator or metal conditioner compatible with the complete paint system. Galvanized metal shall be prepared in accordance with SSPC SP-16. Abrasive blast clean to increase mechanical adhesion in accordance with ASTM D6386, Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting when required by coating manufacturer. Provide a 1.5 mil minimum angular anchor profile unless recommended otherwise by the coating manufacturer in writing.

8. Abrasive blast clean internal and external ductile iron pipe surfaces prior to coating in accordance with NAPF 500-03-04, Surface Preparations Standard for Abrasive Blast Cleaning of Ductile Iron Pipe. Abrasive blast clean internal and external cast ductile iron and cast-iron fitting surfaces in accordance with NAPF-03-05.

9. Prime cleaned metals immediately after cleaning to prevent rusting.

10. Clean rusted metals down to bright metal by abrasive blasting and immediately field primed.

C. Concrete Surface Preparation

1. Cure concrete a minimum of 28 days at 75° F before surface preparation, and painting begins. Allow more time at lower temperatures if specified by paint manufacturer.

2. Test concrete for pH and salts using test methods recommended by the paint manufacturer. A minimum of one test per 1000 square feet of area to be coated shall be performed unless approved otherwise by Engineer. Do not begin surface preparation or painting until acceptable to manufacturer.

3. Moisture content of concrete and masonry surfaces shall conform to manufacturer's recommended limits, and as listed in SSPC-SP13/NACE 6 Section 6 Acceptance Criteria Table 1. Floor surfaces to be coated shall be tested in accordance with ASTM F1869 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride or as required by the coating manufacturer. Moisture vapor transmission shall not exceed three pounds per 1,000 square feet in a 24-hour period or less if specified by Coating Manufacturer. Vertical and horizontal overhead surfaces shall be tested in accordance with ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete using in situ Probes (relative humidity shall not exceed 80% or as required by the coating manufacturer) or with ASTM D4263 – Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Test Method (test results shall be no moisture present). Engineer or Coating Manufacturer Representative shall specify all test locations. A minimum of one test per 1000 square feet of area to be coated shall be performed unless approved otherwise by Engineer.

4. Prepare concrete surfaces to receive coatings in accordance with NACE 6/SSPC-13 – Joint Surface Preparation Standards and ICRI Technical Guidelines. Remove contaminants, open bugholes, surface voids, air pockets, and other subsurface irregularities using abrasive blasting, shot blasting, water jetting or mechanical abrading. Use dry, oil-free air for blasting operations. Surface texture after blasting shall achieve profile as required by manufacturer or where not defined by manufacturer, profile shall be a minimum ICRI-CSP 5 surface profile. Remove residual abrasives, dust, and loose particles by vacuuming or other approved method.

5. Surface defects, such as hollow areas, bugholes, honeycombs, and voids shall be filled with polymeric or waterborne epoxy cementitious filler compatible with painting system. Complete fill coats may be used in addition to specified painting system and as approved by the Engineer. Fins, form marks, and all protrusions or rough edges shall be removed.

6. Repair existing concrete surfaces which are deteriorated to the point that surface preparation exposes aggregate with fill coats or patching mortar as recommended by paint manufacturer and as directed by the Engineer.

7. Clean concrete of all dust, form oils, curing compounds, oil, tar, laitance, efflorescence, loose mortar, and other foreign materials before paints are applied.

8. To ease coating around outside corners, provide ¾-inch chamfered edges on all new concrete outside corners and grind existing concrete outside corners to a minimum radius of ¾-inch.

9. Unless recommended otherwise by the coating manufacturer, provide ¼" deep by ¼" wide tool cut terminations at 1-inch maximum from all coating edges for anchorage. Provide terminations around all equipment, piping, openings, gates, top and bottom of walls, stop locations of each day's work and overlap onto previously completed work. Transition coating 3-inches onto interior lining of piping except where coating compatibility concerns are noted by coating manufacturer.

10. Apply epoxy or polymeric filler compatible with painting system to all inside corners of areas to be coated with a margin trowel to form a continuous 45-degree cant cove across corners with a minimum dimension of 1.5-inch. Roughen or prepare cured filler as recommended by coating manufacturer for proper coating adhesion.

11. All equipment grouting shall be installed and cured prior to starting coating work. Coating shall be applied over grout up to the edges of all equipment, gates and uninterrupted piping unless specifically noted otherwise.

D. Wood

1. Clean wood surfaces free of all foreign matter, with cracks and nail holes and other defects properly filled and smoothed. Remove sap and resin by scraping and wipe clean with rags dampened with mineral spirits.

2. Saturate end grain, cut wood, knots, and pitch pockets with an appropriate sealer before priming.

3. Prime and backprime wood trim before setting in place.

4. After prime coat has dried, fill nailholes, cracks, open joints, and other small holes with approved spackling putty. Lightly sand wood trim prior to applying second coat of paint.

E. Castings

1. Prepare castings for painting by applying a brush or a knife-applied filler. Fillers are not to be used to conceal cracks, gasholes, or excessive porosity.

2. Apply one coat of primer with a minimum thickness of 1.2 mils in addition to coats specified. Allow sufficient drying time before further handling.

F. Masonry

1. Cure for a minimum of 30 days prior to paint application.

2. Clean masonry surfaces free from all dust, dirt, oil, grease, loose mortar, chalky deposits, efflorescence, and other foreign materials.

3. Test masonry for moisture content. Use test method recommended by paint manufacturer. Do not begin painting until moisture content is acceptable to manufacturer.

G. Gypsum Drywall

1. Sand joint compound with sandpaper to provide a smooth flat surface. Avoid sanding of adjacent drywall paper.

2. Remove dust, dirt, and other contaminants.

H. Previously-Painted Surfaces

1. Totally remove existing paint when: surface is to be submerged in a severe environment, paint is less than 75% intact, brittle, eroded or has underfilm rusting.

2. Surfaces which are greater than 75% intact require removal of failed paints and then spot primed. Spot priming is in addition to coats specified.

3. Remove surface contamination such as oil, grease, loose paint, mill scale, dirt, foreign matter, rust, mold, mildew, mortar, efflorescence, and sealers.

4. Clean and dull glossy surfaces prior to painting in accordance with the manufacturer's recommendations.

5. Check existing paints for compatibility with new paint system. If incompatible, totally remove existing paint system or apply a barrier coat recommended by the paint manufacturer. Remove existing paints of undetermined origin. Prepare a test patch of approximately 3 square feet over existing paint. Allow test patch to dry thoroughly and test for adhesion. If proper adhesion is not achieved remove existing paint and repaint.

3.03 APPLICATION OF PAINT

A. Apply paint by experienced painters with brushes or other applicators approved by the Engineer, and paint manufacturer.

B. Apply paint without runs, sags, thin spots, or unacceptable marks.

C. Apply at rate specified by the manufacturer to achieve at least the minimum dry mil thickness specified. Apply additional coats, if necessary, to obtain thickness.

D. Special attention shall be given to nuts, bolts, edges, angles, flanges, welds, etc., where insufficient film thicknesses are likely. Stripe paint outside corners and edges in accordance with SSPC PA Guide 11. Stripe painting shall be in addition to coats specified.

E. Perform thinning in strict accordance with the manufacturer's instructions, and with the full knowledge and approval of the Engineer and paint manufacturer.

F. Allow paint to dry a minimum of twenty-four hours between application of any two coats of paint on a particular surface, unless shorter time periods are a requirement by the manufacturer. Longer drying times may be required for abnormal conditions as defined by the Engineer and paint manufacturer. Do not exceed manufacturer's recommended drying time between coats.

G. Suspend painting when any of the following conditions exist:

1. Rainy or excessively damp weather.

2. Relative humidity exceeds 85%.

3. General air temperature cannot be maintained at 50°F or above through the drying period, except on approval by the Engineer and paint manufacturer.

4. Relative humidity will exceed 85% or air temperature will drop below 40°F within 18 hours after application of paint.

5. Surface temperature of item is within 5 degrees of dewpoint.

6. Dew or moisture condensation are anticipated.

7. Surface temperature exceeds the manufacturer's recommendations.

H. Where application of coating across concrete control joints or expansion joints has the potential to crack, turn coating into joints and caulk joints with a sealant compatible with coating rated for the intended service per Section 07 90 00 – Joint Fillers, Sealants, Caulking.

3.04 INSPECTION

A. Each field coat of paint will be inspected and approved by the Engineer or his authorized representative before succeeding coat is applied. Tint successive coats so that no two

coats for a given surface are exactly the same color. Tick-mark surfaces to receive black paint in white between coats.

B. Use magnetic dry film thickness gauges and wet fiber thickness gauges for quality control. Furnish magnetic dry film thickness gauge for use by the Engineer.

C. Coatings shall pass a holiday detector test.

D. Determination of Film Thickness: Randomly selected areas, each of at least 107.5 contiguous square feet, totaling at least 5% of the entire control area shall be tested. Within this area, at least 5 squares, each of 7.75 square inches, shall be randomly selected. Three readings shall be taken in each square, from which the mean film thickness shall be calculated. No more than 20 percent of the mean film thickness measurements shall be below the specified thickness. No single measurement shall be below 80 percent of the specified film thickness. Total dry film thickness greater than twice the specified film thickness shall not be acceptable. Areas where the measured dry film thickness exceeds twice that specified shall be completely redone unless otherwise approved by the Engineer. When measured dry film thickness is less than that specified additional coats shall be applied as required.

E. Holiday Testing: Holiday test painted ferrous metal surfaces which will be submerged in water or other liquids, or surfaces which are enclosed in a vapor space in such structures. Mark areas which contain holidays. Repair or repaint in accordance with paint manufacturer's printed instructions and retest.

1. Dry Film Thickness Exceeding 20 Mils: For surfaces having a total dry film thickness exceeding 20 mils: Pulse-type holiday detector such as Tinker & Rasor Model AP-W, D.E. Stearns Co. Model 14/20, shall be used. The unit shall be adjusted to operate at the voltage required to cause a spark jump across an air gap equal to twice the specified coating thickness.

2. Dry Film Thickness of 20 Mils or Less: For surfaces having a total dry film thickness of 20 mils or less: Tinker & Rasor Model M1 non-destructive type holiday detector, K-D Bird Dog, shall be used. The unit shall operate at less than 75-volts. For thicknesses between 10 and 20 mils, a non-sudsing type wetting agent, such as Kodak Photo-Flow, shall be added to the water prior to wetting the detector sponge.

F. Paint manufacturer’s NACE certified representative shall provide their services as required by the Engineer. Services shall include, but not be limited to, inspecting existing paint, determination of best means of surface preparation, inspection of completed work, and final inspection of painted work 11 months after the job is completed.

3.05 PROTECTION OF ADJACENT PAINT AND FINISHED SURFACES

A. Use covers, masking tape, other method when protection is necessary, or requested by Owner or Engineer. Remove unwanted paint carefully without damage to finished paint or surface. If damage does occur, repair the entire surface adjacent to and including the damaged area without visible lapmarks and without additional cost to the Owner.

B. Take all necessary precautions to contain dispersion of abrasive blasting debris and paint to the limits of the work. Take into account the effect of wind and other factors which may cause dispersion of the abrasive blasting debris and paint. Suspend painting operations when abrasive blasting debris or paint cannot be properly confined. Assume all responsibilities and cost associated with damage to adjacent structures, vehicles, or surfaces caused by the surface preparation and painting operations.

3.06 PIPING AND EQUIPMENT IDENTIFICATION

A. Piping and equipment identification shall be in accordance with Section 40 05 97 – Piping and Equipment Identification Systems.

3.07 SCHEDULE OF COLORS

A. Match colors indicated. Piping and equipment colors are indicated in Section 40 05 97 – Piping and Equipment Identification Systems. Colors which are not indicated shall be selected from the manufacturer's full range of colors by the Engineer. No variation shall be made in colors without the Engineer's approval. Color names and numbers shall be identified according to the appropriate color chart issued by the manufacturer of the particular product in question.

3.08 WORK IN CONFINED SPACES

A. Provide and maintain safe working conditions for all employees. Supply fresh air continuously to confined spaces through the combined use of existing openings, forced draft fans and temporary ducts to the outside, or direct air supply to individual workers. Exhaust paint fumes to the outside from the lowest level in the contained space. Provide explosionproof electrical fans, if in contact with fumes. No smoking or open fires will be permitted in, or near, confined spaces where painting is being done. Follow OSHA, state, and local regulations at all times.

3.09 OSHA SAFETY COLORS

A. Paint wall around wall-mounted breathing or fire apparatus with the appropriate safety red color; area not to exceed 2 feet wide by 3 feet high, unless apparatus covers the area. Fire apparatus include fire hoses, extinguisher, and hydrants.

B. Paint hazardous areas and objects in accordance with OSHA regulations.

3.10 VOC REGULATIONS

A. Provide paint systems in accordance with local, state, and federal regulations. Where paint systems shown in schedule do not comply, substitute equal products with VOC limits which comply with local, state, and federal regulations.

Table 1: Painting Schedule

Surface	Application	Painting System and No. of Coats	Product Reference (Table 2)	Total Min. Dry Film Thickness (Mils)
Concrete and Masonry				
Interior masonry and concrete walls, columns, beams, and ceilings	All new structures	1 coat sealer 2 coats acrylic epoxy	101 116	75-85 sq.ft./gal. 4-6/coat
Interior masonry and concrete walls, columns, beams, and ceilings in chemical rooms		1 coat sealer 2 coats epoxy polyamide	117 102	60-80 sq.ft./gal. 4-6/coat
Exterior masonry cavity walls on cavity face of inner wythe	All new structures	Cavity drainage	See Section 04 05 19	
Exterior below grade if interior is dry	Accessible areas (e.g., pipe galleries, pump rooms, basements, etc.)	Waterproofing	See Section 07 26 16	
Submerged or occasional contact with potable or raw water	Water retaining side of new wall surfaces where opposite side of wall is interior and dry and where indicated "epoxy waterproofing" on drawing	2 coats NSF 61/600 approved epoxy polyamide Provide filler as required and recommended by manufacturer	105	4-6/coat
Metals				
Interior and exterior nonsubmerged (gloss)	All new blowers, pumps, motors and mechanical equipment, piping, etc.	1 coat epoxy polyamide primer 1 coat epoxy polyamide 1 coat aliphatic polyurethane	104 102 115	4-6 4-6 3-5
Interior insulated		1 coat acrylic latex	103	4
Submerged or occasional contact with potable or raw water	All metal piping, mechanical equipment, etc.	2 coats NSF 61/600 approved epoxy polyamide	105	4-6/coat
Steel doors, windows and door frames, steel stairs, monorails, structural steel, misc. metals (steel), galvanized lintels,		1 coat epoxy polyamide 1 coat aliphatic polyurethane	102 115	5-8 3-4
Aluminum surfaces in contact with concrete		2 coats coal tar	107	26
Shop Primed Structural Steel	Pre-Engineered Buildings	1 tie coat 1 coat epoxy 1 coat epoxy	113 114 120	2-3 3-4 3-4
Other				
Interior: Gypsum Wallboard	All new structures	2 coats acrylic latex matte or satin	103	2-3/coat
Interior: Tar-dipped piping where color is required		1 coats epoxy resin sealer 1 coats epoxy polyamide	112 102	2-3/coat 5-8/coat
PVC Piping		1 coat epoxy polyamide 1 coat aliphatic polyurethane	102 115	5-8 3-4

Note: Painting manufacturer shall verify compatibility of containment liner and chemical to be contained. Where incompatible substitute a compatible coating system.

Table 2: Product Listing

Ref.	System	Purpose	Product (Or approved equal)			
			Tnemec Series	PPG	CARBOLINE	Sherwin-Williams
101	Acrylic filler	Primer-sealer	130-6601	BLOXFIL 400BF	Sanitile 100	Cement-Plex 875
102	Epoxy polyamide	Finish coat semi-gloss or gloss	N69	AMERLOCK 600 (SEMI-GLOSS)	Carboguard 890	Macropoxy 646
103	Acrylic latex	Sealer	1028/1029	PITT TECH PLUS	Carbocrylic 3359DTM	DTM Acrylic Primer/Finish
104	Epoxy Polyamide – metal	Primer	66	AMERCOAT 600	Carboguard 893SG	Macropoxy 646
105	Epoxy polyamide	Primer/Finish	L140	AMERLOCK 2 VOC	Carboguard 61/891VOC	Macropoxy 646 PW
106	Coal tar epoxy	Finish high-coat build	46H-413	AMERCOAT 78HB	Bitumastic 300M	Hi-Mil Sher Tar Epoxy
107	Coal tar	Sealer	46-465	AMERCOAT 78HB	Bitumastic 300M	Hi-Mil Sher Tar Epoxy
108	Alkyd-medium oil	Finish coat	2H	HP INDUSTRIAL ALKYD 4308	Carbocoat 8215	Industrial Enamel
109	Alkyd-long oil	Finish coat	1029	HP INDUSTRIAL ALKYD 4308	Carbocoat 8215	Industrial Enamel
110	Epoxy polyamide	Primer	66-1211	AMERCOAT 600	Carboguard 893SG	Macropoxy 646
112	Epoxy polyamide	Sealer	66-1211	AMERLOCK SEALER	Carboguard 893SG	Macropoxy 920 Pre-Prime
113	Urethane	Barrier coat	530	AMERLOCK SEALER	Rustbond	-
114	Polyamine Epoxy	Intermediate coat	27	AMERLOCK 600	Carboguard 893SG	-
115	Aliphatic Polyurethane	Finish coat	1094 or 1095	PITTHANE ULTRA SERIES	Carbothane 134HG	Acrolon 218HS
116	Acrylic epoxy	Finish coat	113 or 114	AQUAPON WB EP	Sanitile 255	Water-Based Catalyzed Epoxy
117	Epoxy block filler	Sealer	1254	AMERLOCK 400BF	Sanitile 500	Kem Cati-Coat HS Epoxy Filler
118	Catalyzed epoxy	Finish coat	84	AMERLOCK 2/400	Carboguard 890	Macropoxy 646
119	High solids epoxy	Finish coat	104	AMERLOCK 240	Carboguard 890	Dura-Plate 235
120	Epoxy	Top coat	N69	AMERLOCK 240	Carboguard 890	-

END OF SECTION

SECTION 09 97 00

SPECIAL COATINGS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. This Section describes systems of multi-component heavy-duty concrete toppings and multi-component heavy-duty chemical resistant concrete toppings consisting of epoxy and vinyl ester resins, curing agents, aggregates, and inorganic pigments.

B. All systems include scarification, acid etching and other substrate preparations, bond coats, reinforcements, underlayment fills, binder coats, top coats and other components and system accessories recommended by the manufacturer for cast-in-place concrete floor slabs, curbs, equipment pads, tops and sides of containment dike walls, trenches, steps, sumps, equipment pits and similar cast-in-place concrete items, which may be subject to heavy traffic and aggressive chemicals, including manufacturer's recommended details for conditions encountered in the work and a Field Quality Control Report including procedures, test methods, results of tests, remedial recommendations and actions.

C. Provide complete technical services as available from the specified manufacturer and on-site technical representation by manufacturer's Technical Representative during the time of material delivery, storage, job mock-up, substrate preparation and the advancement of installation to thirty percent of floor areas receiving concrete toppings and during the start of field quality control testing.

D. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install, and place into satisfactory service all concrete toppings work.

1.02 REFERENCES

A. NYSBC - 2020 New York State Uniform Code

B. American Standard Testing Methods (ASTM):

1. ASTM C109 - Compressive Strength of Hydraulic Cement Mortars

2. ASTM C150 - Portland Cement

3. ASTM C190 - Tensile Strength of Hydraulic Cement Mortars

4. ASTM C321 - Bond Strength of Chemical-Resistant Mortars

5. ASTM C413 - Absorption of Chemical-Resistant Mortars, Grouts and Monolithic Surfacings

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6. ASTM C501 - Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser

7. ASTM C531 - Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, and Polymer Concretes

8. ASTM C580 - Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts and Monolithic Surfacings and Polymer Concretes

9. ASTM D635 - Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position

10. ASTM D638 - Tensile Properties of Plastics

11. ASTM D696 - Coefficient of Linear Thermal Expansion of Plastics between -30 Degrees C and 30 Degrees C

12. ASTM D790 - Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

13. ASTM D1044 - Resistance of Transparent Plastics to Surface Abrasion

14. ASTM D1308 -Effect of Household Chemicals on Clear and Pigmented Organic Finishes

15. ASTM D2047 - Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine

16. ASTM D2240 - Rubber Property - Durometer Hardness

17. ASTM D4060 - Abrasion Resistance of Organic Coatings by the Taber Abraser

18. ASTM D4263 - Concrete Moisture Test

19. ASTM D4541 - Pull-Off Strength of Coatings Using Portable Adhesion Testers

20. ASTM E84 - Surface Burning Characteristics of Building Materials

21. ASTM E831 - Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis, Standard Test Method for

C. Military Specifications (MIL)

1. MIL 3134 - (Navy) Deck Covering Materials

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1.03 SUBMITTALS

A. The Contractor shall submit the following in accordance with Section 01 33 00 – Submittal Procedures.

B. Samples: Submit for approval the following:

1. Stepped-back concrete toppings system applied to a 12-inch by 12-inch by 2-inch-thick concrete sample showing each system component and demonstrating required surface preparation to be used on job mock-up and required thickness of concrete toppings. Apply concrete toppings to only one-half of the sample board, leaving the other half visible and with required substrate preparation.

2. Full selection of manufacturer's standard and custom colors for selection by Engineer. Engineer will preliminarily select a maximum of twelve colors for consideration for use in the work. Prepare 12-inch by 12-inch samples of each color. From these Engineer will select a maximum of eight colors to be used in the work. Engineer will provide Contractor with locations of each color after this final selection. In addition to color, provide range of textures from smooth to heavily non-slip for selection for use on job mock-up panel.

3. Samples will be reviewed by Engineer for color selection, general appearance and as examples of the types of components to be installed on the job mock-ups. Compliance with other requirements is the responsibility of Contractor.

C. Working Drawings: All products, systems and installation recommendations submitted shall be subject to approval at the time of field quality control testing. Submit for preliminary approval the following:

1. Copies of specifications, technical information, test results, installation instructions and general recommendations from the concrete toppings manufacturer, for each type of concrete toppings product required. Include requirements for environmental conditions and other conditions required for an acceptable installation providing features and performance as stated in manufacturer's literature.

2. Drawings showing extent of each component of each system used in the Work including all items receiving concrete toppings such as equipment pads, curbs, sumps, pipe trenches and similar items and surfaces and all details required for the Work referencing required system components provided as samples to Engineer. Provide Working Drawings coordinated with cast-in-place concrete and showing all construction, and other conditions encountered in the work and manufacturer's approved and recommended details appropriate to construction, expansion and seismic joints as required for full concrete toppings system

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performance whether or not specific indication is made on the Contract Drawings to the details of the specified manufacturer.

3. Show interface details with other items such as thresholds, curbs, coves, equipment pads, expansion and seismic joint cover assemblies, floor hatches, heating registers, ramps, steps and stair nosings.

4. Copies of Material Safety Data Sheets for all products used in the Work and copies of transmittals indicating receipt of MSDS by concrete toppings systems installer.

5. Maintenance Manual: Upon completion of the Work, furnish copies of a detailed maintenance manual for each product, including the following information:

   a. Product name and number.

   b. Name, address and telephone number of manufacturer and local distributor.

   c. Detailed procedures for routine maintenance and cleaning.

   d. Detailed procedures for light repairs such as dents, scratches, and staining.

   e. Material Safety Data Sheets.

D. Test Reports: Submit for approval the following:

1. Copies of test reports verifying compliance with physical properties specified herein.

2. Copies of testing agencies background and experience in performing similar tests to those specified.

3. Copies of final Field Quality Control Test Report as specified. Final payment for the concrete toppings Work is contingent upon Engineer’s approval of final Field Quality Control Report and recommendations for, and completion of, all remedial work.

E. Certificates: Submit for approval the following:

1. Copies of certificates stating that the concrete toppings systems installer has been approved or is a licensee of the concrete toppings manufacturer.

2. Evidence of installer's experience.

3. Evidence prior to delivery that materials and components furnished conform to the Specifications and are as approved on Working Drawings submittals.

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4. Evidence of acceptance of the substrate by the concrete toppings installer and manufacturer's Technical Representative.

F. Contractor's Review: Accompanying approval request, submit specified statement to Engineer. Show by copy of transmittal form that a copy of the statement has been transmitted to the manufacturer.

G. Statement of Application: Upon completion of the concrete toppings work, submit a notarized statement to Engineer as specified.

1.04 QUALITY ASSURANCE

A. Source Quality Control:

1. Engage a single manufacturer who shall provide the services of a Technical Representative who shall assist Contractor, Engineer, and the Owner by providing technical opinions on the adequacy of materials and methods of installation and field quality control testing based on Working Drawings approved by Engineer.

2. Provide such services during the time of delivery, storage, job mock-up construction, installation, and field quality control testing of all concrete toppings components.

3. Provide a manufacturer who will provide complete technical services including preparation and review of Working Drawings, installation methods and proposed detailing for the work. Where the manufacturer requires additions, or changes to the Contract Drawings and Contract Specifications these shall be made at no additional expense to the Owner and only as acceptable to Engineer.

4. Provide only the highest quality materials, environmental features, and methods of construction and installation as recommended by the manufacturer and as acceptable to Engineer.

B. Installer Qualifications:

1. Engage a single installer skilled, trained and with successful experience in the application of each product who is an approved applicator of the manufacturer, or who can submit evidence in writing of being acceptable to the manufacturer for production of guaranteed construction and who agrees to employ only tradesmen with specific skill and successful experience in this type of work. Submit name and qualifications to Engineer along with the following information on a minimum of three successful projects:

a. Names and telephone numbers of owners, architects, or engineers responsible for projects.

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b. Approximate contract cost of the concrete toppings.

c. Amount of area installed.

2. Submit proof of acceptability of installer by manufacturer to Engineer.

C. Performance Criteria:

1. Contractor's Review: Accompanying approval request, submit to Engineer a written statement signed by Contractor, stating that the Contract Drawings and Specifications have been reviewed with an agent of the concrete toppings material manufacturer and that he is in agreement that the selected systems are proper, compatible and that the details used for the work are not in conflict with the manufacturer's details.

2. Statement of Application: Upon completion of the concrete toppings work, submit a notarized statement to Engineer signed by Contractor stating that the work complies with the requirements of these Specifications, was installed in compliance with manufacturer's written recommendations and that the installation methods were proper and adequate for the conditions of installation and use.

D. Allowable Installation Tolerances:

1. Do not install work until substrate preparation and tolerances have been approved by Engineer, concrete toppings manufacturer's Technical Representative and the concrete toppings installer and Contractor has verified to Engineer that substrates are within tolerances specified and acceptable to produce approved work. Work advanced for any reason without such verification shall be stopped, removed and replaced with new material after substrate is approved, at no additional expense to the Owner.

2. Substrate Tolerances:

a. Out-of-Plane: 1/8 inch maximum in 10 foot - 0 inches and 1/16 inch maximum in any 12 inches measured along the plane.

b. Maximum Offset in Plane Alignment: 1/16 inch.

c. Variation From Slope: 1/8 inch maximum in 10 foot - 0 inches.

3. Concrete Toppings Tolerances:

a. Finished concrete toppings level to 1/8 inch in 10 feet - 0 inches with smooth continuous uniformly sloped-to-drain planes.

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b. Provide smooth continuous color with no color streaks or inconsistencies with smoothly textured non-slip finish.

E. Requirements of Regulatory Agencies:

1. All material provided under this Section shall comply with the Specifications.

2. Comply with all applicable requirements of governing authorities and codes for all work.

3. In those instances where the Commissioner of Buildings requires a certificate of compliance of the manufacturer or producer certifying that the item or product system was tested and is equivalent to material of the same kind and quality regularly being manufactured by such manufacturer or producer Contractor shall provide all such certificates to the Commissioner of Buildings without additional expense to the Owner.

F. Testing Agency: Engage a testing laboratory regularly engaged in the testing of construction materials, and who complies with ASTM E329.

G. Pre-installation Meeting:

1. Before erecting job mock-up, Contractor, his concrete toppings installer, and Technical Representative of the concrete toppings system manufacturer shall meet on-site with Engineer to discuss approved products and workmanship to ensure proper application of concrete toppings system components and substrate preparation requirements for the work.

2. Record the discussions of the conference and the decisions and agreements or disagreements reached, and furnish a copy of the record to each party attending. Review foreseeable methods and procedures related to the concrete toppings work, including, but not necessarily limited to, the following:

a. Review project requirements (Drawings, Specifications and other Contract Documents).

b. Review required submittals, both completed and yet to be completed.

c. Review status of substrate work, including approval of surface preparations, drying, structural loading limitations and similar considerations.

d. Review requirements of field quality control testing and requirements for preparing field quality control report as specified herein.

e. Review availability of materials, tradesmen, equipment and facilities needed to make progress and avoid delays.

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f. Review required inspection, testing and certifying.

g. Review environmental conditions, other job conditions, and procedures for coping with unfavorable conditions.

h. Review regulations concerning code compliance, environmental protection, health, safety, fire and similar considerations.

i. Review procedures needed for protection of concrete toppings during the remainder of the construction period.

3. Reconvene the meeting at the earliest opportunity if additional information must be developed in order to conclude the subjects under consideration.

4. Record any revisions or changes agreed upon, reasons therefore, and parties agreeing or disagreeing with them.

H. Job Mock-Up:

1. Prior to the installation of concrete toppings systems, but after Engineer's approval of Working Drawing submittals, erect stepped-back job mock-ups using substrate preparation, materials and application techniques specified for final work. Provide all components of the concrete toppings systems showing the correct installation, substrate preparation and the workmanship quality which shall be achieved in the work. Build mock-ups at the site, in location approved by Engineer, of full thickness and approximately 12 foot - 0 inches square. Indicate the proposed workmanship to be expected in the finished work. Include methods of installation typical to the work including penetrations, crack and joint sealer system and cove details using all system components required for the Work. Obtain Engineer's acceptance of mock-up before start of work. Retain and protect mock-up before start of work. Retain and protect mock-up during construction as a standard of judging completed work. Do not alter or destroy mock-up until given written permission by Engineer.

2. Build as many job mock-ups as necessary in order to achieve Engineer's acceptance of the work.

3. Concrete toppings work which proceeds without an approved job mock-up shall be stopped, removed and re-installed, after job mock-up approval, at no additional expense to the Owner.

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1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Failure to comply with the following shall be sufficient cause for rejection of materials by Engineer and his requiring its removal from the site. Supply new material at no additional expense to the Owner.

B. Delivery of Materials:

1. Deliver materials in concrete toppings manufacturer's original unopened and undamaged containers, with information accurately representing container contents as approved by Engineer at time of Working Drawing submission.

2. Include the following information on the label:

a. Name of material and supplier.

b. Installation, handling and protection requirements.

3. Deliver materials in sufficient quantities to allow uninterrupted continuity of the Work.

C. Storage of Materials:

1. Store only approved materials on project site.

2. Store materials in original, undamaged containers with the manufacturer’s labels and seals intact.

3. Store all materials in a dry, enclosed area, off the ground and away from all possible contact with water and in a location where temperature can be constantly maintained between 60^{o}F and 75^{o}F and out of direct sunlight.

4. Prevent damage to materials during storage primarily by minimizing the amount of time they are stored at the jobsite before being incorporated into construction systems.

D. Handling of Materials:

1. Do not handle, open, or mix component materials unless concrete toppings can be properly handled as recommended by the manufacturer of the concrete toppings.

2. Do not open containers or expose materials to detrimental conditions. Materials which are so exposed shall be removed from the site and shall not be incorporated into the work.

3. Handle materials carefully and in a manner which prevents contamination and inclusion of foreign materials.

4. Do not open packages or containers until all necessary preparatory work is complete, approved and installation will begin immediately.

1.06 JOB CONDITIONS

A. Environmental Conditions:

1. Remove all chemicals, compounds, and other materials where such materials are unacceptable to manufacturers of concrete toppings systems work from substrates to receive the flooring specified at no additional expense to the Owner, even if chemicals, compounds and other materials are permitted by other Sections of the Specifications.

2. Proceed with concrete toppings work only when temperature and moisture content of concrete slabs, building air temperature, relative humidity and other conditions comply with the concrete toppings manufacturer's written recommendations and when no damaging environmental conditions are forecasted for the time when the materials will be subject to such environmental damage.

3. Maintain substrate temperature and room temperature before, during and after installation above 50^{o}F and rising in accordance with concrete toppings material manufacturer's instructions. Provide adequate ventilation during application and curing periods.

4. Do not begin concrete toppings work until buildings are enclosed and manufacturer’s recommended environmental conditions can be maintained and only when manufacturer and installer are willing to guarantee the work as required and without additional reservations and restrictions.

5. Site Facilities: Supplemental heat sources as may be required should Contractor wish to continue concrete toppings work in cold weather are not available at the project site. Provision of all supplemental heat, energy sources and equipment are the exclusive responsibility of Contractor, as is the requirement that the source of supplemental heat shall not emit contaminants which will adversely affect the color, cure or performance of the concrete toppings. Concrete toppings systems so affected shall be removed and replaced with new at no additional expense to the Owner.

6. Record decisions, conditions, and agreements to proceed with the Work when environmental conditions might be unfavorable. State the reasons for proceeding, with the names of the persons involved along with the changes, if any, or revisions, requirements, or terms of the Contract. Include all information in final Field Quality Control Report.

B. Protection:

1. Protect materials against damage by construction activities.

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2. Protect all concrete toppings materials and system components from all contact with non-associated construction traffic.

3. Do not install concrete toppings when adequate protection of the work is not, or cannot, be made available.

C. Scheduling and Coordination:

1. Review installation procedures under other Sections and Contracts and coordinate them with the work specified herein.

2. Notify other Contractors in advance of the installation of work to provide them with sufficient time for installation and coordination of interrelated items that are included in their contracts and that must be installed in conjunction with the concrete toppings work.

3. Proceed with the concrete toppings and associated work after projections and penetrations through the substrates have been installed, and when the substrate construction and framing of openings is complete.

4. Coordinate and schedule scarification, grinding and filling of cast-in-place concrete with cementitious underlayments, in order to bring substrate within tolerances specified, and abrasive blasting of substrates and installation of concrete toppings before equipment and similar items are installed to avoid later difficulty or delay in performing the concrete toppings work. In order to advance the work be prepared to schedule multiple visits of concrete topping installer to the project site for the purpose of installing concrete toppings in areas that will become inaccessible with the installation of other work as may be required for proper sequencing of the work.

5. Coordinate required thickness of cementitious underlayments with doors, thresholds, piping and equipment, adjacent materials, and similar items in order to provide smoothly aligned transitions acceptable to Engineer and in compliance with governing authorities.

D. Substitutions:

1. Do not change products, system components, colors or manufacturers after Working Drawing and Samples approvals by Engineer.

2. Clearly identify, in a manner which is highlighted to Engineer, all proposed substitutions, modifications, variations, unspecified features and "or approved equal" products. Provide complete comparative data with specified products at time of Working Drawing submission.

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1.07 GUARANTEES

A. Guarantee that all work performed under this Section is free from defects in material and workmanship and conforms to all standards in the manufacturer's published data sheets. Guarantee shall extend to all aspects of the work, including, but not limited to, substrate preparation, materials and installation techniques.

B. Provide a three-year written guarantee starting on the date of the Owner's acceptance of the completed construction work, signed by the Contractor, stating that should concrete toppings show signs of chemical or physical deterioration, delamination or improper installation they will be removed and reinstalled using materials and methods specified herein at no further cost to the Owner. Concrete toppings which fail due to abnormal use shall not be included under the guarantee.

C. Repairs and replacements required because of acts of God and other events beyond Contractor's/installer's/manufacturer's control (and where actual conditions exceed performance requirements specified) shall be completed by Contractor/installer and paid for by the Owner at prevailing rates, only if requested by the Owner

PART 2 – PRODUCTS

2.01 PRODUCTS AND MANUFACTURERS

A. For Interior Areas: Floors, walls, equipment pads, concrete curbs and as indicated on contract drawings. For Exterior Areas: Areas shall be coated with a chemical resistant coating system with a slip resistant walking surface, where indicated on contract drawings.

B. Provide one of the following:

1. Tnemec products as listed below:

a. Vertical Surfaces, Interior and Exterior Exposure: (1/8-inch thickness) used for all vertical conditions.

1)	MVT Coating:	Tnemec 218 at approx. 1/16"
2)	Primer:	201 or 237 at 5-6 mils dft, allow to get tacky
3)	Mortar coat: or 237 tacky	239SC Mortar at 60-80 mils dft while Tnemec 201
4)	Reinforcing:	211-0215 fiberglass mat
5)	Saturant coat:	239SC at 12-15 mils dft

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6) Finish coat: 282 Tneme-Glaze at 10-12 mils dft. Reinforcing mesh must be completely encapsulated. Additional 280 (282) will be required depending on surface irregularities and condition of overlap of mesh at seams.

7) Note: large air holes and spalls should be filled with appropriate Tnemec filler such as 218, 215 or 217 as required for uniform thickness. Provide UV resistant additional finish coat: 290 CRU at 2-3 mils dft over the 280 (282).

b. Horizontal Surfaces, Interior and Exterior Exposure: (1/4-inch thickness)

1) MVT Coatings: Tnemec 242 at approx. 3/16" with full broadcast (of 30-50 mesh sand) to refusal. Sweep and vacuum excess sand

2) Grout Coat: 201 or 237SC or 237 Power Tread to grout the 242 mortar and embed reinforcing mat

3) Reinforcing: 211-0215 Fiberglass Mat

4) Saturant Coat: 239 or 239SC Chembloc Saturant Coat to fully saturate and cover the reinforcing. Broadcast non-skid aluminum oxide aggregate into the wet 239/239SC to required slip resistance as approved by the Engineer on mockup. Nominal 30-50 grit at 4-5 lbs/100 sf.

5) Finish Coat: 282 Tnemec-Glaze with additional grit finish if necessary (For a non-slip surface through floor area) at 12-15 mils dft

6) Protective Coat: Tnemec 290 CRU (Exterior application only) 2-3 mils dft

7) Joint Sealant: Polysulfide Caulk

8) OR provide the equivalent Tnemec vinyl ester system 251/252SC as a finish coat with the same thickness and number of coats indicated above.

2. Dudicks, Inc. products listed as follows:

a. System total thickness, vertical surfaces 1/8" minimum, horizontal surfaces 1/4" minimum. Full System Assembly for interior and exterior exposure: Protecto-Flex 805 system consisting of:

1) VB: Vapor Stop moisture control at 60 mils DFT

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2) Primer: Primer 67

3) Basecoat: Protecto-Flex 805

4) Reinforcement: One layer of one ounce fiberglass mat

5) Saturant: Flexibilized epoxy resin

6) Topcoat: Protecto-Flex 805 20 mils (provide aluminum oxide for abrasion resistance anti-slip finishes) with grit fin**i**sh texture.

7) Protective Coat for UV protection (Exterior exposure only): Sealer 30

8) Joint Sealant: Polysulfide Caulk 149.

3. Stonhard Products as listed below:

a. Vertical Surfaces, Interior and Exterior Exposure: (1/8-inch thickness) used for all vertical conditions

1) Stonchem 877

2) MVT Coating: Stonset PC3 @ 1/16”

3) Primer: Stonchem 800 primer 5 mils

4) Mortar coat: Stonchem 800 Series Mortar 80 mils

5) Reinforcing: Engineering Fabric 1 oz. per Sq. Ft.

6) Saturant coat: Stonchem 800 Series Saturant 30 mils (includes fabric)

7) Finish coat: Stonchem 800 Series Topcoat 10 – 12 mils WFT

b. Horizontal Surfaces, Interior: (1/4-inch thickness)

1) Stonchem 858

2) Stonhard Urethane Primer

3) Mortar coat: Stonclad UR @ 1/8”

4) Primer: Stonchem 700/800 Primer @ 5 mils

5) Reinforcing: Engineering Fabric 1 oz. per sq. ft.

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6) Saturant coat: Stonchem 800 Series Saturant @ 30 mils (includes fabric)

7) Finish coat: Stonchem 800 /820 Series Topcoat 10 – 12 mils WFT

8) Joint Sealant: Polysulfide Caulk

c. Horizontal Surfaces, Exterior Exposure (1/4-inch thickness)

1) Stonchem 858 HD

2) Stonhard Urethane Primer

3) Mortar coat: Stonclad UR @ 1/8”

4) Primer: Stonchem 700/800 Primer @ 5 mils

5) Reinforcing: Engineering Fabric 1 oz. per sq. ft.

6) Saturant coat: Stonchem 800 Series Saturant @ 30 mils (includes fabric)

7) Finish coat: Stonchem 800 /820 Series Topcoat 10 – 12 mils WFT

8) Wear Course: Aluminum Oxide Broadcast to refusal @ n/a

9) Topcoat coat: Stonchem 800 /820 Series Topcoat 4 - 6 mils WFT

10) Joint Sealant: Polysulfide Caulk

4. Or approved equal.

2.02 MATERIALS / EQUIPMENT

A. Chemical Resistant Concrete Topping: Provide the following chemical resistant topping all individual components of which shall be capable of, and recommended by the manufacturer for, immersion in the reagent specified for one year without loss of specified properties or color and which is capable of resisting heavy traffic.

1. Etch: Provide manufacturer's recommended scarification surface preparation.

2. Bond Coat: As recommended by the manufacturer.

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3. Reinforcement: Provide a glass cloth reinforced system using materials recommended for the system and chemical resistance specified. Provide Type H glass cloth.

4. Underlayment Fill: As recommended by the manufacturer.

5. Binder: Troweled vinyl ester composition flooring.

6. Top Coats: Non-slip with complete selection of manufacturer's top coats for maximum chemical resistant.

7. Termination Strips: White metal, tapered bar type as recommended by the manufacturer.

8. Physical Properties: The complete installation when thoroughly cured shall have the following physical properties:

   a. Tensile Strength, ASTM D 638: 2,700 pounds per square inch minimum.

   b. Indentation, MIL-D-3134F, PAR. 4.7.3: 0.062 inches maximum.

   c. Bond Strength, ASTM C 321: 400 pounds per square inch minimum.

   d. Flame Spread, ASTM D 635: Self-extinguishing.

   e. Thermal Coefficient of Linear Expansion, ASTM C 531: 2 x 10^-5 inches per inch per degree-F maximum.

   f. Abrasive Resistance, ASTM D 4060: 0.10-gram maximum weight loss.

   g. Flexural Strength, ASTM C 580: 8,000 pounds per square inch minimum.

   h. Compressive Strength, ASTM C 109: 11,000 pounds per square inch minimum.

   i. Surface Hardness, ASTM D 2240: Scale "D" 85-90.

   j. Water Absorption, MIL-D-3134, 4.78: 0.12.

   k. Chemical Resistance, ASTM D 1308:

1. Colors: Selected from complete range of manufacturer's standard and custom colors.

2. Textures: Non-slip surface.

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PART 3 – EXECUTION

3.01 EXAMINATION / PREPARATION

A. Inspection

1. The Contractor shall examine the surfaces to receive concrete toppings, and the conditions under which the trowel-applied concrete toppings work is to be performed and notify Engineer in writing of all conditions detrimental to the proper and timely completion of the work and the performance of the concrete toppings systems. Do not proceed with the concrete toppings work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.

B. Substrate Preparation

1. Concrete must be prepared mechanically to remove surface laitance. Oils, grease, and other contaminants must be removed prior to surface preparation. Concrete must be free of curing compounds and form release agents. Surface texture should be similar to 40-60 grit sandpaper or the visual standard, CSP-5 from the International Concrete Repair Institute with exposed pea gravel. The prepared surface should have a nominal tensile strength of 250 PSI per ASTM D-4541.

2. All concrete substrates must be checked for moisture prior to any concrete topping application using the Plastic Sheet Test per ASTM D-4263.

3. Additional surface preparation will be required if a 40-60 grit texture with exposed pea gravel is not achieved, and the surface laitance not completely removed with the first mechanical preparation procedure at no cost to the owner.

4. Provide cast-in-place concrete slabs free from voids and sharp projections before placing any concrete toppings system. Remove surface irregularities on cast-in-place concrete and fill all holes, honeycombs, spalls and cracks using manufacturer's recommended cementitious underlayment. Repair areas of unacceptable consolidation.

5. Fill or grind concrete substrate as may be required to achieve a uniform, level finished appearance on finished work.

6. Prior to start of applying flooring, vacuum surfaces to be covered and inspect the subfloor.

7. Primer: Apply primer as recommended by concrete toppings manufacturer, prior to application of the base coat. Apply in accordance with manufacturer's directions as approved by Engineer at time of Working Drawing submission.

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3.02 INSTALLATION

A. Do not power trowel concrete toppings unless manufacturer provides written certification approved by Engineer that material shall experience no loss in compressive strength or tensile strength.

B. Apply termination and expansion joint strips at the junction of the flooring with other materials and at expansion joints as recommended by the manufacturer.

C. Mix materials and apply bonding coat in accordance with manufacturer's instructions.

D. Apply epoxy and vinyl ester mortar floor topping body coats to not less than 1/4-inch dry cured minimum thickness. Apply epoxy and vinyl ester mortar floor topping body coats of greater wet film thickness to compensate for any loss of volatile compounds during curing.

E. Apply glass reinforcement as specified.

F. Apply grout coats to smooth body coat.

G. Power sand to remove trowel marks.

H. Apply top coat sealer material for maximum chemical resistance as recommended by the manufacturers. Apply a final top coat, to match the texture of the approved job mock-up.

3.03 FIELD TESTING / QUALITY CONTROL

A. General: Before general installation of concrete toppings work commences, perform the following field quality control tests and include procedures and results in final Field Quality Control Report. Incorporate installation or system improvements, as may be recommended based on test results, into the remainder of the Work at no additional expense to the Owner.

B. Decorative Concrete Toppings: Before commencement of installation, and after approval of job mock-up and substrate preparations, test concrete toppings system for a period of one month by installing a 200 square foot section within the plant in a location directed by Engineer. Installation shall be supervised and approved by manufacturer’s Technical Representative as an acceptable installation. Subject this test area to the full range of wear which is likely to be seen in the finished work. At the completion of test, the flooring shall show no signs of delamination, premature wearing, deterioration in excess of manufacturer’s approved test data, and no signs of cracking, crazing or color changes. If the test area demonstrates these features the concrete topping material shall be rejected by Engineer and another test may be performed at the expense of Contractor. If the heavy-duty concrete topping fails to perform according to Specification at the completion of this second test, the heavy-duty concrete toppings system shall be

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rejected and an “approved equal” product shall be submitted for approval by Contractor. Test “approved equal” product as specified herein.

C. At the end of the quality control test periods and before general installation commences, the installer, Contractor, Technical Representative and Engineer shall make final inspections of concrete toppings systems and Contractor shall prepare a written report to Engineer with copy to the Owner describing all methods, observations, results and deterioration or damage found in the Work with recommendations for correcting such damage. Include photographic record of all test areas before, during and after the tests and photos of damages and physical changes in the concrete toppings. The report shall contain all comments made by all parties, test results, and manufacturer’s performance claims as preliminarily approved by Engineer at time of Working Drawing submittal as compared to the actual results of the field testing. Make changes to report as required by Engineer for approval of the work. Include quality control test report as part of final Field Quality Control Report.

3.04 ADJUSTING / PROTECTION / CLEANUP

A. Upon completion of the work the installer shall advise Contractor of recommended procedures for his surveillance and protection of the concrete toppings work during the remainder of the construction period.

B. Do not allow construction traffic which is not associated with the installation of the concrete toppings and related materials in the area of work. Concrete toppings shall be kept free of all traffic for a minimum of 72 hours after completion of top coating. Protect installed concrete toppings from damage, by use of heavy Kraft paper or other covering so that concrete toppings are without damage, or unusual or accelerated wear at time of Final Acceptance.

C. Concrete toppings damaged in any manner shall be replaced at no additional expense to the Owner.

D. Only the installer shall replace deteriorated or defective Work found at the time of final inspection. Only the installer shall be engaged by Contractor to repair damages to the concrete toppings work which occurred subsequent to concrete toppings installation and prior to final inspection. Replace the work so that there will be no question as to the condition of concrete toppings and associated work at the time of Final Acceptance.

E. After construction work is completed in the areas of concrete toppings, and before Final Acceptance by the Owner, clean all floors and other surfaces containing concrete toppings using methods recommended by the concrete toppings manufacturer.

F. The concrete toppings at the time of Final Acceptance shall be clean and without damage and shall not be soiled in any way. Vacuum and wet mop areas which become soiled after initial cleaning, up to the time of Final Acceptance by the Owner.

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END OF SECTION

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IDENTIFYING DEVICES

PART 1 – GENERAL

1.01 SUMMARY

A. Identifying devices as specified herein shall include stand signs, and Numbers Signs and appurtenances.

B. Identifying devices shall be provided where shown on the Contract Drawings, specified in the Contract, or as required for a complete installation.

C. The Contractor shall implement practices and procedures to meet the project's sustainability goals as identified in the Contract Documents. The Contractor shall ensure that the sustainability requirements of this Section are implemented to the fullest extent.

D. Related Sections

1. Section 03 30 00 – Cast-in-Place Concrete

2. Section 04 22 23.23 – Prefaced Concrete Unit Masonry

3. Section 05 05 23 – Metal Fastening

1.02 REFERENCES

A. OSHA 1910.145

B. OSHA 1910.157

C. NYSBC New York State Building Code

D. ANSI/ICC A117.1 Accessible and Usable Buildings and Facilities

E. Structural AWS A5.12 Tungsten and Tungsten Alloy Electrodes for Arc

F. AWS Standard Codes for Arc and Gas Welding in Building Construction

1.03 DESCRIPTION

A. Sustainable Design Requirements

1. Adhesives: As recommended by sign manufacturer and with a VOC content of 70 g/L or less for adhesives used inside the weatherproofing system and applied on-site when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesives: Do not use adhesives that contain added urea formaldehyde.

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3. Composite Wood and Agrifiber Products: Do not use composite wood and agrifiber products that contain added urea formaldehyde.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Engage a single fabricator, with undivided responsibility for detailing and performance of the signage structure and wall mounted metal lettering.

2. Engage a firm which can show five years previous successful experience in detailing and fabrication of signage paneling, signage structures, and metal lettering, of scope and type similar to the required work.

3. Materials and fabrication procedures shall be subject to inspection and tests in the mill, shop, and field, conducted by a qualified inspection agency. Such inspections and tests shall not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.

B. Installer Qualifications:

1. Engage a single installer skilled, trained and with documented successful experience in the installation of signage structures and wall mounted metal lettering, and with specific skill and successful experience in the erection of the types of materials required; and who agrees to employ only tradesmen with specific skill and successful experience in this type of Work. Submit names and qualification to Engineer along with the following information on a minimum of three successful projects:

a. Names and telephone numbers of owner, architects or engineers responsible for projects.

b. Approximate contract cost of the identifying devices.

c. Quantity of identifying devices installed.

C. Source Quality Control:

1. Obtain all signage structure components and accessories from the same manufacturer.

2. Provide qualified welding processes and welding operators in accordance with AWS “Structural Welding Code” D1.1, Section 5, Qualification.

3. Provide certification that all welders employed on, or to be employed for, the fabrication of the signage structures and wall mounted metal lettering, have

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satisfactorily passed AWS qualification tests within the previous twelve months. Contractor shall ensure that all certifications are kept current.

1.05 SUBMITTALS

A. The Contractor shall submit for approval, catalog cuts, shop drawings, and reference materials in accordance with Section 01 33 00 – Submittal Procedures.

B. Shop Drawings

1. The Contractor shall submit copies of specifications, installation instructions and general recommendations from the identifying device manufacturers, for each type of identifying device product. Manufacturer's data substantiating that the materials comply with the requirements of the Contract Documents shall be included.

2. Drawings showing extent of the Work and all details required for the Work referencing system components provided as samples, and shall include:

a. Complete details for all signs giving sizes and styles of lettering and colors.

b. Complete schedules for all signs, and building name letters giving location, message, letter, size, color, and method of attachment.

c. Details of fabrication and attachment of all items.

d. Complete location plan for all sign types.

C. Samples

1. Submit for approval color and finish samples of each identifying device product, including each accessory and miscellaneous material to be used in the Work.

D. Mockups

1. Mockups of each type of Identifying Device including wall mounded letters, shall be done in shop and await approval before installation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials:

1. Materials shall not be delivered to the project site before the time of installation.

2. Materials shall be delivered in sufficient quantities to allow continuity of the Work.

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3. All welding and fastening shall be done in shop prior to delivery to the site to minimize installation time.

B. Storage of Materials:

1. Materials shall be stored in original, undamaged containers with manufacturer's labels and seals intact.

2. All materials shall be stored in a dry, enclosed area, off the ground and away from all possible contact with water, ice or snow.

3. Damage to materials during storage shall be prevented by minimizing the amount of time they are stored at the site before being incorporated into the Work.

C. Handling of Materials:

1. Materials shall be handled in such a manner to avoid damage or breakage.

2. Materials shall not be exposed to detrimental conditions or physical damage. Materials which are so exposed shall be removed from the site and shall not be incorporated into the Work.

3. Packages or containers shall not be opened until all necessary preparatory Work is complete and installation is to begin immediately. Materials shall not be allowed to become wet or soiled or covered with ice or snow.

1.07 SPECIAL WARRANTY PROVISIONS / GUARANTEE PERIODS

A. The Contractor shall provide a manufacturers warrantee for a minimum of five (5) years.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted for approval by the Engineer.

1. Standard Signs, Raised Signs, Projected Signs, and Floor Diagram Exit Signs:

a. Sign Graphics, Inc., Richmond, VA;

b. Or approved equal.

2. Safety Stripes Tape:

a. Permacel - P-32;

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b. Or approved equal.

3. Safety/Regulatory Signs

a. Lab Safety Supply - B120 Series (fiberglass);

b. Or approved equal.

2.02 MATERIALS / EQUIPMENT

A. Standard Signs: Standard signs shall be as follows:

1. All letters, numbers and/or symbols shall contrast with their background and shall consist of either white characters on a dark background, or black characters on a light background.

2. Sign characters and background shall have satin finish.

3. Plate material shall be:

a. Acrylic approximately 1/8-inch thick, with surface painted, both face and returns. Coating shall be acrylic polyurethane paint, satin finish, color shall be as selected from manufacturer's standard.

4. Lettering style shall be Helvetica medium, upper case.

5. Corners shall be 1/4-inch radius.

6. All mounting hardware shall be provided, with the manufacturer' standard holes and screws.

B. Raised signs shall be as follows:

1. Raised signs shall be of the three-in-one construction style having the following characteristics:

a. One-piece construction with tactile characters and symbols raised 1/32-inch from sign plate face. Added-on or engraved characters are unacceptable.

b. Grade 2 braille raised 1/32-inch from sign plate face and placed directly below each line of letters or numbers. Braille shall remain color of faceplate.

c. All letters, numbers and symbols shall contrast with their background and shall consist of either white characters on a dark background or black characters on a light background.

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2. Plate material shall be:

   a. Phenolic photo polymer, approximately 1/8-inch thick, with surface painted, both face and returns. Coating shall be acrylic polyurethane pain, satin finish, color selected from manufacturer's standard.

3. Lettering style shall be Helvetica medium, upper case.

4. Corners shall be 1/4-inch radius.

5. All mounting hardware shall be provided, with manufacturer's standard holes and screws.

C. Plastic door numbers and room nameplates shall be made from laminated phenolic engraving stock, with 3/4-inch high standard block lettering, "Helvetica" style. Door numbers, plates and shall be as indicated on the Contract Drawing. Provide door numbers and room nameplates on all doors for all designated rooms indicated on the signage schedule on the Contract Drawings.

1. Provide Braille translation cast into background to all rooms.

D. Projected signs shall be as follows:

1. All letters, numbers and/or symbols shall contrast with their background and shall consist of either white characters on a dark background, or black characters on a light background.

2. Plate material shall consist of phenolic photo polymer, approximately 1/8-inch thick, with surface painted, including both sides and all edges.

3. Projected sign shall be mounted to bracket with two small screws and nuts.

4. Lettering style shall be Helvetica medium, upper case.

5. Corners shall be 1/4-inch radius.

6. Finish shall be acrylic polyurethane coating; color shall be as selected from manufacturer's standard.

7. Mounting hardware for each projected sign shall consist of a 4-inch high aluminum bracket with satin silver finish. The bracket shall be mounted to wall surface with four countersunk screw type anchors.

E. Floor Diagram Exit Signs: Provide fire evacuation schematics sign as follows:

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1. All letters, numbers and symbols shall contrast with the color of the background material. Window plate shall have white characters on dark background, with matte finish. Removable insert shall have black characters on light background.

2. Window plate material shall consist of matte acrylic, approximately 1/16- inch thick with the surface screened and painted. Window slot shall remain clear and shall be mounted to backplate with 1/16-inch clear acrylic with spacer for the insert extended to the edge.

3. Backplate material shall consist of Komatex of the same size as window plate. Backplate material shall be approximately 1/8-inch thick and color shall be white.

4. Removable insert material shall consist of paper stock.

5. Lettering style shall be Helvetica medium, upper case.

6. Finish shall be acrylic polyurethane coating; color shall be as selected from manufacturer's standard.

7. All mounting hardware shall be provided, with the manufacturer's standard holes and screws.

8. Quantity: One (1) sign at every pull box.

F. Safety and regulatory shall conform to OSHA Regulations 1910.145 and 1910.157 and shall be as follows:

1. Accident prevention signs are classified as follows:

a. Danger signs shall indicate an immediately hazardous situation which, if not avoided, will result in death or serious injury. Danger is limited to the most extreme situations. Color scheme shall be red, black and white.

b. Warning signs shall indicate a potentially hazardous situation which, if not avoided, could result in death or serious injury. Color scheme shall be orange background, with a black and orange panel with black letters.

c. Caution signs shall indicate a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. Caution signs may also be used to alert against unsafe practices. Color scheme shall be yellow background, with a black panel with yellow letters.

d. Notice signs shall indicate a statement of company policy as the message relates directly or indirectly to the safety of personnel or protection of property. Color scheme shall be white background, with a blue panel with white letters.

e. General safety signs shall indicate general instructions relative to safe work practices, reminders of property safety procedures, and the location of safety equipment. Color scheme shall be white background, with a green panel with white letters.

f. Fire prevention signs shall indicate the location of exit or emergency firefighting equipment. Color shall be red and white.

g. Directional arrow signs shall indicate the direction to exit, emergency equipment, safety equipment and other locations important to safety. Color shall be red and black.

2. Plate material shall be:

a. Fiberglass reinforced polyester with protected graphics, approximately 0.10-inch thick.

b. Rigid acrylic, approximately 1/8 inch thick.

c. Aluminum plate thickness 1/16-inch thick with overlaminated graphics.

3. Lettering style shall be Helvetica medium, upper case.

4. All mounting hardware shall be provided, with manufacturer's standard holes and screws.

5. The Contractor shall provide and install quantity of signs listed in the Signage Schedule on the Contract Drawings and as indicated in "Danger Sign Schedule" and "Fire Equipment Location Markers" below. The locations shall be as directed by the Engineer.

6. Safety Stripes Tape: Tape shall meet the requirements of OSHA 1910.144 and shall be as follows:

a. Tape shall be 2-inch wide pressure sensitive reinforced vinyl tape, white with black stripes.

b. A minimum of 50 yards of the tape shall be provided and shall be installed as directed by the Engineer.

PART 3 – EXECUTION

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3.01 EXAMINATION / PREPARATION

A. The Contractor shall verify that areas to receive identifying devices are properly prepared and completed.

3.02 INSTALLATION

A. All materials specified herein shall be installed in compliance with the New York State Building Code, ANSI A117, OSHA regulations, and the approved manufacturer's printed specifications. Mounting devices, bolts, screws, nuts, and the like shall be in accordance with Section 05 05 23 – Metal Fastening and the Contract Drawings.

B. Identifying devices shall be installed where shown on the Contract Drawings.

3.03 ADJUSTING / PROTECTION / CLEANUP

A. Adjustment: System components which are dislodged, damaged, expanded, broken, penetrated or crushed by subsequent installation operations or damaged by detrimental weather shall be immediately replaced with undamaged material in compliance with the Contract Specifications and properly protected as specified.

B. Protection: Identifying devices shall be protected from all damage and abuse from all other Contractors and installers involved in the Work until Final Acceptance by the Owner.

C. Cleaning: Upon completion of the project, all protection devices shall be removed and identifying devices shall be touched up as necessary. All exposed surfaces shall be cleaned using a mild solution of detergent and warm water. All surfaces shall be left in a neat and clean condition.

END OF SECTION

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SECTION 10 44 16
FIRE EXTINGUISHERS

PART 1 – GENERAL

1.01 SUMMARY

A. The Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install fire extinguishers, complete and operational, with cabinets and all anchor bolts, fasteners, and accessories.

1.02 RELATED SECTIONS

A. Section 05 05 23 – Metal Fastening

1.03 REFERENCES

A. Abbreviations and Acronyms:

1. DC = Dry Chemical

2. CO2 = Carbon Dioxide

B. Reference Standards:

1. NFPA 10 Portable Fire Extinguishers.

1.04 SUBMITTALS

A. Submittals shall comply with the requirements of the Contract Documents. In addition, submittals shall include, but not be limited to, the following:

1. Action Submittals:

a. Shop Drawings:

1) Complete detail and installation drawings for fire extinguishers and cabinets.

2) Wall mount hardware.

2. Information Submittals:

a. Manufacturer's specification data sheets and verification of UL ratings.

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1.05 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall deliver equipment provided under this Section in accordance with the requirements of the Contract Documents.

B. The Contractor shall store and handle equipment provided under this Section in accordance with the requirements of the Contract Documents.

1.06 SPECIAL WARRANTY PROVISIONS / GUARANTEE PERIODS

A. All products specified under this Section shall be covered under the manufacturer's standard warranty unless specified otherwise.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Products shall be as manufactured by:

1. Kidde Fenwal Inc., Ashland, MA.
2. Ansul Inc., Marinette, WI.
3. Potter – Roemer Inc., Union, NJ.
4. Firemaster, Fort Myers, FL.
5. Or approved equal.

2.02 MATERIALS / EQUIPMENT

A. The Contractor shall provide the quantity and type of fire extinguishers in the locations directed in the field by the Engineer. Provide the following with wall hanging hardware:

Type	Quantity
10 lb Dry Chemical	As indicated on the Contract Drawings. Also include two additional 10 lb Dry Chemical Fire Extinguishes
10 lb CO2	As indicated on the Contract Drawings. Also include two additional 10 lb Fire Extinguishers.

B. Dry Chemical (DC) fire extinguishers shall be ten (10) lb. capacity, hand portable type with wall mount, tri-class dry chemical type with corrosion-resistant shell, with Underwriters' Laboratories rating of 4-A:60-BC.

C. Carbon Dioxide (C02) fire extinguishers shall be ten (10) lb. capacity, hand portable type with wall mount and corrosion-resistant shell, having Underwriters' Laboratories rating of 10-BC.

D. Provide corrosion-resistant wall-mounting bracket for each fire extinguisher.

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PART 3 – EXECUTION

3.01 INSTALLATION

A. Install fire extinguishers in complete accordance with the manufacturer's printed instructions and the approved shop drawings.

1. Fire extinguishers shall be installed where shown on the Contract Drawings and as directed by the Engineer.

B. Wall mounts for extinguishers shall be securely mounted to surface in accordance with Section 05 05 23 – Metal Fastenings.

C. Fire extinguishers shall be installed so that the top of the fire extinguisher is not more than five (5) feet above the finished floor.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 10 71 19

FLOOD BARRIERS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. The Contractor shall furnish, fabricate, and install flood barriers. The flood barriers shall be provided complete with all accessories and fastenings required for a satisfactory installation.

1.02 RELATED SPECIFICATIONS

A. Section 03 30 00 – Cast-in-Place Concrete

B. Section 05 05 23 – Metal Fastening

1.03 REFERENCE STANDARDS

A. All work shall comply with the current New York State Building Code.

B. ASTM E 84 - Surface Burning Characteristics of Building Materials.

C. FEMA Technical Bulletin 3-93 - Non-Residential Flood Proofing.

D. AWS Structural Welding Code.

E. ASME Liquid Penetrant Inspection Section VIII.

F. SEI/ASCE 24 Floor Resistant Design and Construction.

1.04 DESIGN REQUIREMENTS

A. The Contractor shall supply the fabricated flood barriers as per the Contract Drawings and as follows:

1. Design loads considered shall be in accordance with FEMA Technical Bulletin 3-93 - Non-Residential Flood Proofing and SEI/ASCE 24 Flood Resistant Design and Construction Requirements.

2. Design watertight stackable stop plank (or stop log) flood barrier to perform under hydrostatic loads (and hydrodynamic or other loads as specified) to control short-term load pressures indicated. All water pressure loads and operating loads are transferred to the building structure.

    a. Hydrostatic Loading.

    b. Wind Loading

3. Provide FM Global labeled flood barrier demonstrating ANSI/FM 2510 Approval for dynamic impact testing and hydrostatic testing meeting leakage requirements of less than 0.08 gallon per hour per linear food of wetted perimeter over any 15-minute period.

    a. Maximum Hydrostatic Water Protection Heights: Up to 6 feet.

    b. Maximum Panel Section Width: Up to 9 feet.

    c. Maximum Structural Opening Length: Up to 10 feet, with 3 feet W.P.H. or less.

4. Engineering Code Practices: Engineer flood products to conform to the design requirements that are based on the latest adopted edition of the Building Code of New York State are applied as appropriate to align with specific project specifications and/or limited published material data.

5. Water Density: 64 pcf, unless otherwise noted on “Approved for Construction” drawings.

6. Deployment: No sealant required on planks during deployment – watertight protection that deploys quickly without mess or drying time.

7. The barrier shall be designed such that it attaches to the wet side of the building envelope and load is transferred from the flood barrier to the structural concrete wall through bearing.

1.05 QUALITY ASSURANCE

A. Shop Inspections

1. Shop inspections may be made by the Owner or its representative.

2. The Contract shall give ample notice to the Engineer prior to the beginning of any fabrication, so that the inspection may be made.

3. The Owner and/or its representative may conduct the following quality assurance inspection operations at the manufacturer’s facility:

    a. Visual inspection of welding, as per AWS D1.6.

    b. Visual and dimensional inspection welding of completed work.

B. Manufacturer Experience: The manufacturer shall provide information supporting at least five (5) years of experience in the design and manufacture of the product specified.

1.06 SUBMITTALS

A. The Contractor shall prepare and submit to the Engineer for approval, shop drawings and other material required to substantiate conformance in accordance Section 01 33 00 – Submittal Procedures.

B. Shop drawings shall include but not be limited to:

1. Dimensioned plans and elevations, sections, connections, anchorage, and parts list.

2. Calculations: Submit calculations, certified by a New York State Registered Professional Engineer, to verify the barrier's ability to withstand the design pressure loading.

3. Certified weld inspection reports.

4. Copies of certified materials test reports, both chemical and physical and test report for susceptibility to intergranular corrosion.

5. The manufacturer's specifications, load table, installation instructions, setting drawings and templates for location and installation of miscellaneous metal items, appurtenances and anchorage devices.

C. The following samples shall be furnished:

1. Representative samples of bolts, anchors, inserts, gasket types.

D. List of material manufacturers with the components provided, including but not limited to mill test reports.

1.07 DELIVERY, STORAGE AND HANDLING

A. Shall be transported, handled, and stored without being over-stressed, deformed or otherwise damaged and as per the manufacturer's instructions and recommendations.

B. Coatings shall be applied in the shop; the units are to be delivered ready for installation.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Flood Barriers shall be manufactured by:

1. Presray Corporation, Wassaic, NY;

2. Basis of Design: Model FP-530 FM HYDRODEFENSE FLOOD PLANK as manufactured by PS Industries Incorporated, Grand Forks, ND;

3. Floodproofing, Mt. Royal, NJ;

4. Or approved equal.

2.02 MATERIAL/EQUIPMENT

A. Stackable flood barrier shall not require the use of center mullions.

B. Flood barrier metals shall be aluminum: 6061 - T6.

C. Jambs shall be provided with the manufacturer's removable protective covers. Jambs and removable protective covers shall be aluminum extrusions. Each Jamb shall be affixed with an aluminum tag identifying the manufacturer, model, and serial numbers of the flood barrier.

D. Finish: Flood barrier assembly, jambs and removable jamb covers shall be clear anodized aluminum.

E. Gaskets: Factory mounted, compressible rubber type, field replaceable. Gasket does not require air inflation.

1. Material: UV resistant EPDM unless otherwise noted.

F. Hardware: compression brackets, hold down brackets, turn knobs, bolts, anchors, and all necessary parts to render the flood barrier systems operational. Bolts, anchors, and washers shall be provided by the manufacturer.

G. Operating Hardware:

1. Provide hardware sized for the size and weight of the flood plank and loads.

2. Hardware to be factory located on jambs and plank panels, as practical.

3. Latching hardware to be as indicated on manufacture standard hardware.

H. Design:

1. Frame shall have mounting holes for fasteners in accordance with Section 05 05 23 – Metal Fastening.

I. Embedded angle with Nelson studs, Stainless Steel Type 304, mill finish.

J. Storage Rack:

1. Basis of design: HydroDefense Flood barrier System.

2. Provide wall mounted storage rack system for the complete storage of the Flood Barriers.

2.03 SOURCE QUALITY CONTROL

A. The manufacturer shall have and perform quality control operations based on a written quality control program that includes the following:

1. Review and rejection of incoming materials based on certified test reports and visual inspections.

2. Frequency of inspection and inspection requirements.

3. All quality control inspection reports shall be dated and maintained by the flood panel/barrier manufacturer for a minimum period of seven years.

4. All prototype test records for custom flood panels/barriers and all production test records shall be dated and maintained by the flood panel/barrier manufacturer for a minimum period of seven (7) years.

5. All prototype test records for the manufacturer's standard flood panel/barrier designs shall be permanently archived.

PART 3 – EXECUTION

3.01 FACTORY TESTING/QUALITY CONTROL

A. Finished assembly or assembly similar in design shall be factory leak tested to verify that it will withstand the design hydrostatic pressure.

B. All welds on flood barrier assemblies that may be potential "leak path" shall be liquid penetrant inspected in accordance with ASME section VIII Div. of Appendix 8.

3.02 SITE INSPECTION AND FIELD VERIFICATION

A. The Contractor shall verify that the area to receive the barrier is properly prepared and set to the proper elevation.

B. Contract shall meet the requirements of the manufacturer's installation recommendations and approved shop drawings.

C. Do not begin installation until substrates have been properly prepared.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Field Testing:

1. Perform visual dry test for gasket alignment, continuity contact and pre-compression.

2. Construct temporary water barrier and test installed flood barrier.

F. Products to be operated and field verified including the sealing surfaces to assure that they maintain contact at the correct sealing points.

G. Verify that hinging and latching assemblies operate freely and correctly.

H. Verify all anchorage is in accordance with manufacture's installation instructions and applicable data sheets.

3.03 INSTALLATION

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

B. Coordinate Work with other operations and installation of adjacent materials to avoid damage.

C. Install in accordance with the manufacturer's installations instructions, approved shop drawings, shipping, handling, and storage instructions, and product carton instructions for installation.

D. Flood panel or barrier shall be installed on the wet side of the building envelope

E. Flood panel/barrier(s) and their components shall be adjusted for proper alignment and operation.

F. Touch-up, repair or replace damaged installed products or components.

G. Clean all sealing surfaces.

H. Protect installed products until completion of Contract.

END OF SECTION

SECTION 22 05 23

VALVES FOR PLUMBING PIPING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Brass ball valves.

2. Bronze ball valves.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 Annex G.

PART 2 – PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.

2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

3. ASME B16.18 for solder-joint connections.

4. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 Annex G for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:

1. Handlever: For quarter-turn valves smaller than NPS 4.

2.02 BRASS BALL VALVES

A. Brass Ball Valves, Two-Piece with Full Port and Brass Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Jomar Valve;

b. NIBCO INC;

c. WATTS;

d. Or approved equal.

2. Description:

a. Standard: MSS SP-110.

b. CWP Rating: 600 psig.

c. Body Design: Two piece.

d. Body Material: Forged brass.

e. Ends: Threaded and soldered.

f. Seats: PTFE.

g. Stem: Brass.

h. Ball: Chrome-plated brass.

i. Port: Full.

2.03 BRONZE BALL VALVES

A. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. NIBCO INC.;

b. WATTS;

c. Zurn Industries, LLC.;

d. Or approved equal.

2. Description:

a. Standard: MSS SP-110.

b. CWP Rating: 600 psig.

c. Body Design: Two piece.

d. Body Material: Bronze.

e. Ends: Threaded and soldered.

f. Seats: PTFE.

g. Stem: Bronze or brass.

h. Ball: Chrome-plated brass.

i. Port: Full.

PART 3 – EXECUTION

3.01 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

3.02 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

2. For Steel Piping, NPS 2 and Smaller: Threaded ends.

3.03 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.

2. Brass ball valves, two-piece with full port and brass trim.

3. Bronze ball valves, two-piece with full port and bronze or brass trim.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metal pipe hangers, rods, and supports.

2. Fastener systems.

3. Pipe positioning systems.

B. Related Sections:

1. Section 05 05 23 – Metal Fastening

2. Section 09 90 00 – Painting

1.02 PERFORMANCE REQUIREMENTS

A. Structural Seismic considerations: the Building Code of the State of New York, latest edition (including amendments) shall be in effect. Submit shop drawings for all electrical supports and anchors that include seismic restraint calculations and details as required to meet earthquake design data indicated on structural Drawings. Calculations and details, if required, shall be designed and stamped by a New York registered professional engineer retained by the Contractor.

1.03 ACTION SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Equipment supports.

1.04 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.05 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

2.01 METAL PIPE HANGERS AND SUPPORTS

A. 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.

4. Stainless Steel shall be 316

2.02 FASTENER SYSTEMS

A. Refer to Section 05 05 23 – Metal Fastening.

2.03 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.04 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 – EXECUTION

3.01 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. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

C. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

D. 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.

E. Install lateral bracing with pipe hangers and supports to prevent swaying.

F. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

G. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

H. 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.

3.02 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.

3.03 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 09 90 00 – Painting.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.04 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 attachments for hostile environment applications.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.

4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.

6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.

8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.

9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 deg F 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. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

   a. Light (MSS Type 31): 750 lb.

   b. Medium (MSS Type 32): 1500 lb.

   c. Heavy (MSS Type 33): 3000 lb.

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

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.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.

3. 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.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

B. Related Sections:

1. Section 09 90 00 – Painting

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 – PRODUCTS

2.01 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    a. Brady Corporation;
    b. Carlton Industries, LP;
    c. Emedco;
    d. Or approved equal.
2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
3. Letter Color: Black.
4. Background Color: White.

5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

7. 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-quarters the size of principal lettering.

8. Fasteners: Stainless-steel rivets.

9. 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), and 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 bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 WARNING SIGNS AND LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Emedco;

2. National Marker Company;

3. Stranco, Inc;

4. Or approved equal.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

C. Letter Color: White.

D. Background Color: Red.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. 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-quarters the size of principal lettering.

H. Fasteners: Stainless-steel rivets.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Label Content: Include caution and warning information plus emergency notification instructions.

2.03 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Kolbi Pipe Marker Co;

2. Emedco;

3. Carlton Industries, LP;

4. Or approved equal.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: Size letters according to ASME A13.1 for piping.

PART 3 – EXECUTION

3.01 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.

3.02 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.03 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Section 09 90 00 – Painting.

B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.

4. At access doors, manholes, and similar access points that permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Effluent Water Piping: White letters on safety-grey background.

2. Sanitary Waste Piping: Black letters on safety-grey background.

END OF SECTION

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SECTION 22 11 16
WATER PIPING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Stainless steel pipe and fittings.
2. Piping joining materials.
3. Transition fittings.
4. Dielectric fittings.

B. Related Sections:

1. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
2. Section 22 05 53 – Identification for Plumbing Piping and Equipment

1.02 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.03 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

PART 2 – PRODUCTS

2.01 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article of this Section for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

C. Comply with NSF Standard 372 for low lead.

2.02 STAINLESS STEEL PIPE AND FITTINGS

A. Heavy wall stainless steel pipe and fittings shall be Type 316L stainless steel fabricated in accordance with ASTM A312/312M for nominal pipe sizes up to twelve (12) inches.

B. Wall thickness shall be Schedules 40S or 80S pipe in accordance with ANSI B36.19 and as indicated on the piping schedule in the Detailed Specifications.

C. Where flanges are shown, specified or required for connection of stainless steel pipe and fittings to pipe equipment, forged stainless steel slip-on flanges conforming to ANSI 150 pound or 300 pound standards, shall be provided as specified in the Detailed Specifications, welded at the hub and at the face. Flanges, flanged fittings, and flanged joints shall conform to the applicable provisions specified herein for steel flanges, flanged fittings and flanged joints, except that steel bolting shall be cadmium plated to produce a uniform appearance.

D. Fittings:

1. For nominal pipe sizes two (2) inches and smaller shall be of the socket-welding type conforming to the dimensional requirements of ASME B16.11.

2. For nominal pipe sizes 2-1/2” inches and larger shall be butt-welding type conforming to the dimensional requirements of ASME B16.9.

3. Fittings shall conform to the materials and alloy requirements of ASTM A403/A403M

E. All stainless steel pipe and fittings shall be precleaned, pickled, and passivated after fabrication in accordance with the applicable sections of ASTM A380, except where otherwise specified in the Detailed Specifications.

2.03 PIPING JOINING MATERIALS

A. No welding of stainless steel will be permitted

2.04 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.

2. Pressure rating at least equal to pipes to be joined.

3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.05 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. WATTS;

b. Wilkins;

c. Zurn Industries, LLC;

d. Or approved equal.

2. Standard: ASSE 1079.

3. Pressure Rating: 125 psig minimum at 180 deg F.

4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. WATTS;

b. Wilkins;

c. Zurn Industries, LLC;

d. Or approved equal.

2. Standard: ASSE 1079.

3. Factory-fabricated, bolted, companion-flange assembly.

4. Pressure Rating: 125 psig minimum at 180 deg F.

5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

PART 3 – EXECUTION

3.01 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance.

C. Install shutoff valve immediately upstream of each dielectric fitting.

D. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

E. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

F. 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.

G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

H. Install piping to permit valve servicing.

I. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

J. Install piping free of sags and bends.

K. Install fittings for changes in direction and branch connections.

3.02 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 pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

E. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.03 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

3.04 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

3.05 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation in Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment.

1. Vertical Piping: MSS Type 8 or 42, clamps.

2. Individual, Straight, Horizontal Piping Runs:

a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.

c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

D. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.

2. NPS 1-1/2: 108 inches with 3/8-inch rod.

3. NPS 2: 10 feet with 3/8-inch rod.

4. NPS 2-1/2: 11 feet with 1/2-inch rod.

5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.

6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.

E. Install supports for vertical steel piping every 15 feet.

F. Support piping and tubing not listed in this article according to MSS SP-58 and manufacturer's written instructions.

3.06 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.

2. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.07 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 22 05 53 – Identification for Plumbing Piping and Equipment.

B. Label pressure piping with system operating pressure.

3.08 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.

2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.

d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

b. 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 a separate report for each test, complete with diagram of portion of piping tested.

c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.

f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.09 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.

2. Open shutoff valves to fully open position.

3. Open throttling valves to proper setting.

4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.

b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.

6. Remove and clean strainer screens. Close drain valves and replace drain plugs.

7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.

8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.

b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.

2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

d. Repeat procedures if biological examination shows contamination.

e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Domestic water piping shall be the following:

1. Stainless steel pipe, stainless steel fittings joints.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 22 11 19
PIPING SPECIALTIES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Backflow Preventors
2. Hose Bibbs
3. Water-hammer arresters.
4. Trap-seal primer valves.
5. Cleanouts.
6. Roof flashing assemblies.
7. Miscellaneous sanitary drainage piping specialties.

B. Related Sections:

1. Section 07 60 00 – Sheet Metal Flashing and Trim
2. Section 26 05 26 – Grounding

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.03 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.04 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 – PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 Annex G.

B. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

2.02 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.03 BACKFLOW PREVENTORS

A. Backflow Preventors:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    1) Watts, Andover, MA;

    2) Zurn Wilkins, Milwaukee, WI;

    3) Or approved equal.

2. Construction:

    a. Standard: ASSE 1013.

    b. Operation: Continuous-pressure applications.

    c. Body – Bronze.

    d. End Connections – Threaded.

    e. Configuration – Designed for horizontal, straight-through flow.

    f. Valves – Ball type with threaded ends on inlet and outlet.

2.04 HOSE BIBBS

A. Hose Bibbs:

1. Type: Chicago pattern.

2. Materials: Bronze body with brass trim.

3. Operator: Tee handle.

4. Pipe End Connection: Threaded.

5. Hose Connection: Three-quarter (3/4)-inch NPT for three-quarter (3/4) inch hose, quick connect couplings for larger hoses.

2.05 WATER-HAMMER ARRESTERS

A. Water-hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    1) AMTROL, Inc.;

    2) WATTS;

    3) Zurn Industries, LLC.;

    4) Or approved equal.

2. Standard: ASSE 1010 or PDI-WH 201.

3. Type: Copper tube with piston.

4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.06 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Jay R. Smith Mfg Co; a division of Morris Group International;

    b. WATTS;

    c. Zurn Industries, LLC.;

    d. Or approved equal.

2. Standard: ASSE 1018.

3. Pressure Rating: 125 psig minimum.

4. Body: Bronze.

5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.

6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.

7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.07 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Jay R. Smith Mfg Co; a division of Morris Group International;

b. Josam Company;

c. WATTS;

d. Or approved equal.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.

3. Size: Same as connected drainage piping

4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.

5. Closure: Raised-head, cast-iron plug.

6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

7. Closure: Stainless-steel plug with seal.

2.08 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Acorn Engineering Company; a Division of Morris Group International;

b. Zurn Industries, LLC;

c. Or approved equal.

2. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch- thick, lead flashing collar and skirt extending at least 10 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

    a. Open-Top Vent Cap: Without cap.

    b. Low-Silhouette Vent Cap: With vandal-proof vent cap.

    c. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.09 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564 rubber gaskets.

2. Size: Same as connected waste piping.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.

2. Size: Same as connected waste piping.

    a. NPS 2: 4-inch-minimum water seal.

    b. NPS 2-1/2 and Larger: 5-inch-minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.

2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.

2. Body: Bronze or cast iron.

3. Inlet: Opening in top of body.

4. Outlet: Larger than inlet.

5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.

2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.

2. Size: Same as connected stack vent or vent stack.

G. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.

2. Size: Same as connected stack vent or vent stack.

H. Expansion Joints:

1. Standard: ASME A112.6.4.

2. Body: Cast iron with bronze sleeve, packing, and gland.

3. End Connections: Matching connected piping.

4. Size: Same as connected soil, waste, or vent piping.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install backflow preventers in each water supply to equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.

2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two (2) pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.

3. Do not install bypass piping around backflow preventers.

B. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

C. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve.

D. Set nonfreeze, nondraining-type post hydrants in concrete or pavement.

E. Install water-hammer arresters in water piping according to PDI-WH 201.

F. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

G. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.

2. Locate at each change in direction of piping greater than 45 degrees.

3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.

4. Locate at base of each vertical soil and waste stack.

H. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

I. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

J. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Section 07 60 00 – Sheet Metal Flashing and Trim.

K. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Section 07 60 00 – Sheet Metal Flashing and Trim.

L. Install vent caps on each vent pipe passing through roof.

M. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

3.02 CONNECTIONS

A. Comply with requirements for ground equipment in Section 26 05 26 – Grounding.

3.03 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.04 FLASHING INSTALLATION

A. Comply with requirements in Section 07 60 00 – Sheet Metal Flashing and Trim.

B. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required.

C. 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, and skirt or flange extending at least 8 inches around pipe.

2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.

3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

D. Set flashing on floors and roofs in solid coating of bituminous cement.

E. Secure flashing into sleeve and specialty clamping ring or device.

F. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 07 60 00 – Sheet Metal Flashing and Trim.

G. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing

3.05 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

NO TEXT ON THIS PAGE

SECTION 22 13 16
SANITARY WASTE AND VENT PIPING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.

2. Specialty pipe fittings.

B. Related Sections:

1. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment

2. Section 22 05 53 – Identification for Plumbing Piping and Equipment

3. Section 22 11 19 – Piping Specialties

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.03 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.

B. Field quality-control reports.

PART 2 – PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.02 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.03 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.04 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2. Unshielded, Nonpressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Dallas Specialty & Mfg. Co.;

2) Fernco Inc.;

3) Or approved equal.

b. Standard: ASTM C 1173.

c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

d. End Connections: Same size as and compatible with pipes to be joined.

e. Sleeve Materials:

1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.

2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.

3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

3. Shielded, Nonpressure Transition Couplings:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

        1) Cascade Waterworks Mfg. Co.;

        2) Mission Rubber Company, LLC; a division of MCP Industries;

        3) Or approved equal.

    b. Standard: ASTM C 1460.

    c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

    d. End Connections: Same size as and compatible with pipes to be joined.

PART 3 – EXECUTION

3.01 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.

2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.

2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.

a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.

4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

a. Reducing size of waste piping in direction of flow is prohibited.

K. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.

2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.

3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

L. 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."

M. Plumbing Specialties:

1. Install backwater valves in sanitary waster gravity-flow piping.

a. Comply with requirements for backwater valves specified in Section 22 11 19 – Piping Specialties.

2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.

a. Comply with requirements for cleanouts specified in Section 22 11 19 – Piping Specialties.

3. Install drains in sanitary waste gravity-flow piping.

a. Comply with requirements for drains specified in Section 22 11 19 – Piping Specialties.

N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.02 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

3.03 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.

2. In Waste Drainage Piping: Shielded, nonpressure transition couplings.

3.04 VALVE INSTALLATION

A. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.

2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.

3. Install backwater valves in accessible locations.

4. Comply with requirements for backwater valve specified in Section 22 11 19 – Piping Specialties.

3.05 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment.

1. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
2. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
3. Vertical Piping: MSS Type 8 or Type 42, clamps.
4. Install individual, straight, horizontal piping runs:
5. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
6. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
7. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
8. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
9. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.

H. Install supports for vertical steel piping every 15 feet.

I. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2: 84 inches with 3/8-inch rod.
2. NPS 3: 96 inches with 1/2-inch rod.
3. NPS 4: 108 inches with 1/2-inch rod.

J. Install supports for vertical stainless-steel piping every 10 feet.

K. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

3.06 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.

5. Install horizontal backwater valves with cleanout cover flush with floor.

6. Comply with requirements for backwater valves cleanouts and drains specified in Section 22 11 19 – Piping Specialties.

7. Equipment: Connect waste piping as indicated.

   a. Provide shutoff valve if indicated and union for each connection.

   b. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.07 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 22 05 53 – Identification for Plumbing Piping and Equipment.

3.08 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 and before setting fixtures.

2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent 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.

    a. 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 waste and vent piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

    a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.

    b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.

    c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

    a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.

    b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.

    c. Air pressure must remain constant without introducing additional air throughout period of inspection.

    d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

6. Prepare reports for tests and required corrective action.

3.09 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Repair damage to adjacent materials caused by waste and vent piping installation.

3.10 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

C. Aboveground, vent piping NPS 4 and smaller shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

END OF SECTION

SECTION 22 13 19
SANITARY WASTE PIPING SPECIALTIES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Cleanouts.
2. Roof flashing assemblies.
3. Miscellaneous sanitary drainage piping specialties.

B. Related Sections

1. Section 07 60 00 – Sheet Metal Flashing and Trim
2. Section 22 05 53 – Identification for Plumbing Piping and Equipment
3. Section 22 13 16 – Sanitary Waste and Vent Piping
4. Section 26 05 26 – Grounding

1.02 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene.

B. PVC: Polyvinyl chloride.

1.03 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.04 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 – PRODUCTS

2.01 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

2.02 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:

1. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
2. Size: Same as connected drainage piping
3. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure: Countersunk or raised-head, cast-iron plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
6. Closure: Stainless-steel plug with seal.

B. Cast-Iron Exposed Floor Cleanouts:

1. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
2. Size: Same as connected branch.
3. Type: Threaded, adjustable housing.
4. Body or Ferrule: Cast iron.
5. Outlet Connection: Threaded.
6. Closure: Cast-iron plug.
7. Adjustable Housing Material: Cast iron with threads.
8. Frame and Cover Material and Finish: Painted cast iron.
9. Frame and Cover Shape: Round.
10. Top Loading Classification: Heavy Duty.
11. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Standard: ASME A112.36.2M. Include wall access.
2. Size: Same as connected drainage piping.

3. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.

4. Closure Plug:

   a. Cast iron.

   b. Countersunk or raised head.

   c. Drilled and threaded for cover attachment screw.

   d. Size: Same as or not more than one size smaller than cleanout size.

      1) Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

      2) Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.03 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch-thick, lead flashing collar and skirt extending at least 6 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

   a. Open-Top Vent Cap: Without cap.

   b. Low-Silhouette Vent Cap: With vandal-proof vent cap.

   c. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.04 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Floor-Drain, Trap-Seal Primer Fittings :

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.

2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

B. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.

2. Size: Same as connected stack vent or vent stack.

C. Expansion Joints:

1. Standard: ASME A112.6.4.

2. Body: Cast iron with bronze sleeve, packing, and gland.

3. End Connections: Matching connected piping.

4. Size: Same as connected soil, waste, or vent piping.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.

2. Locate at each change in direction of piping greater than 45 degrees.

3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.

4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Section 07 60 00 – Sheet Metal Flashing and Trim.

E. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Section 07 60 00 – Sheet Metal Flashing and Trim.

F. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.

2. Size: Same as floor drain inlet.

G. Install vent caps on each vent pipe passing through roof.

H. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

I. Install wood-blocking reinforcement for wall-mounting-type specialties.

J. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.02 CONNECTIONS

A. Comply with requirements in Section 22 13 16 – Sanitary Waste and Vent Piping for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Ground equipment according to Section 26 05 26 – Grounding.

3.03 FLASHING INSTALLATION

A. Comply with requirements in Section 07 60 00 – Sheet Metal Flashing and Trim

B. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required.

C. 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 and skirt or flange extending at least 8 inches around pipe.

2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.

3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

D. Set flashing on floors and roofs in solid coating of bituminous cement.

E. Secure flashing into sleeve and specialty clamping ring or device.

F. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 07 60 00 – Sheet Metal Flashing and Trim.

G. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.04 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

1. Nameplates and signs are specified in Section 22 05 53 – Identification for Plumbing Piping and Equipment.

3.05 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

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fastener systems.

2. Equipment supports.

1.02 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 equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.03 ACTION SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Equipment supports.

1.04 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.05 QUALITY ASSURANCE

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

PART 2 – PRODUCTS

2.01 METAL PIPE HANGERS AND SUPPORTS

A. 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.

2.02 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type, stainless- 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.

2.03 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.04 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 – EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

A. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

a. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

b. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

c. 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.

d. Install lateral bracing with pipe hangers and supports to prevent swaying.

e. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

3.02 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for 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.

3.04 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.

3.05 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

3.06 HANGER AND SUPPORT SCHEDULE

A. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

B. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

C. 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. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.

    b. Medium (MSS Type 32): 1500 lb.

    c. Heavy (MSS Type 33): 3000 lb.

        1) Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

        2) Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

D. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.

3. 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.

E. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 23 05 48

VIBRATION CONTROLS FOR HVAC

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Spring hangers.

B. Related Sections:

1. Section 05 05 23 – Metal Fastening

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Delegated-Design Submittal: For each vibration isolation device.

1. Include design calculations for selecting vibration isolators.

1.03 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

PART 2 – PRODUCTS

2.01 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    a. Ace Mountings Co., Inc.;
    b. Kinetics Noise Control, Inc.;
    c. Mason Industries, Inc.;

d. Or approved equal

2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.

3. Size: Factory or field cut to match requirements of supported equipment.

4. Pad Material: Oil and water resistant with elastomeric properties.

5. Surface Pattern: Smooth pattern.

6. Infused nonwoven cotton or synthetic fibers.

7. Load-bearing metal plates adhered to pads.

2.02 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Ace Mountings Co., Inc.;

b. Kinetics Noise Control, Inc.;

c. Mason Industries, Inc.;

d. Or approved equal.

2. Mounting Plates:

a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.

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.

2.03 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Ace Mountings Co., Inc.;

    b. Mason Industries, Inc.;

    c. Vibration Eliminator Co., Inc.;

    d. Or approved equal.

2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.

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.

7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.

8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.

9. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

PART 3 – EXECUTION

3.01 VIBRATION CONTROL DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 05 05 23 – Metal Fastening.

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stress or misalignment.

END OF SECTION

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Duct labels.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 – PRODUCTS

2.01 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    a. Carlton Industries, LP;
    b. Champion America;
    c. Emedco;
    d. Or approved equal.
2. Material and Thickness: Anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
3. Letter Color: Black.
4. Background Color: White/Bare Metal.
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-quarters 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.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 WARNING SIGNS AND LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Emedco;

2. National Marker Company;

3. Stranco, Inc;

4. Or approved equal.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

C. Letter Color: White.

D. Background Color: Red.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. 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-quarters the size of principal lettering.

H. Fasteners: Stainless-steel rivets or self-tapping screws.

I. Label Content: Include caution and warning information plus emergency notification instructions.

2.03 DUCT LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Carlton Industries, LP;

2. Emedco;

3. Seton Identification Products; a Brady Corporation company;

4. Or approved equal.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

C. Letter Color: Blue – Supply and Green – Exhaust.

D. Background Color: White.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. 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-quarters the size of principal lettering.

H. Fasteners: Stainless-steel rivets or self-tapping screws.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

PART 3 – EXECUTION

3.01 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.

3.02 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.03 DUCT LABEL INSTALLATION

A. Install plastic-laminated self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For cold-air supply ducts.

2. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.

B. Locate labels near points where ducts enter into and exit from concealed spaces and in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

B. Related Sections

1. Section 23 31 16 – Nonmetal Ducts

2. Section 23 33 00 – Air Duct Accessories

1.02 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

F. TDH: Total dynamic head.

1.03 INFORMATIONAL SUBMITTALS

A. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in Article 3.02 "Preparation" of this Section.

B. Certified TAB reports.

1.04 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC NEBB or TABB.

2. TAB Technician: Employee of the TAB specialist and certified by AABC NEBB or TABB 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."

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 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, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. 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 equipment performance data including fan 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.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. 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.

I. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible, and their controls are connected and functioning.

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.

3.02 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures for balancing the systems.

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. Duct systems are complete with terminals installed.

b. Volume, smoke, and fire dampers are open and functional.

c. Clean filters are installed.

d. Fans are operating, free of vibration, and rotating in correct direction.

e. Variable-frequency controllers' startup is complete and safeties are verified.

f. Automatic temperature-control systems are operational.

g. Ceilings are installed.

h. Windows and doors are installed.

i. Suitable access to balancing devices and equipment is provided.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" 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 23 33 00 – Air Duct Accessories.

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.

3.04 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. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. 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.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

K. Verify that air duct system is sealed as specified in Section 23 31 16 – Nonmetal Ducts.

3.05 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.

3.06 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: No greater than 10% over designed airflow.

2. Air Outlets and Inlets: Plus or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.07 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.

2. Include a list of instruments used for procedures, along with proof of calibration.

3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.

2. Manufacturers' test data.

3. Field test reports prepared by system and equipment installers.

4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.

2. Name and address of the TAB specialist.

3. Project name.

4. Project location.

5. Architect's name and address.

6. Engineer's name and address.

7. Contractor's name and address.

8. Report date.

9. Signature of TAB supervisor who certifies the report.

10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.

11. Summary of contents including the following:

    a. Indicated versus final performance.

    b. Notable characteristics of systems.

    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.

13. Data for terminal units, including manufacturer's name, type, size, and fittings.

14. Notes to explain why certain final data in the body of reports vary from indicated values.

15. Test conditions for fans and pump performance forms including the following:

a. Settings for outdoor-, return-, and exhaust-air dampers.

b. Conditions of filters.

c. Cooling coil, wet- and dry-bulb conditions.

d. Face and bypass damper settings at coils.

e. Fan drive settings including settings and percentage of maximum pitch diameter.

f. Inlet vane settings for variable-air-volume systems.

g. Settings for supply-air, static-pressure controller.

h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.

2. Water and steam flow rates.

3. Duct, outlet, and inlet sizes.

4. Pipe and valve sizes and locations.

5. Terminal units.

6. Balancing stations.

7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

a. Unit identification.

b. Location.

c. Make and type.

d. Model number and unit size.

e. Manufacturer's serial number.

f. Unit arrangement and class.

g. Discharge arrangement.

h. Sheave make, size in inches, and bore.

i. Center-to-center dimensions of sheave and amount of adjustments in inches.

j. Number, make, and size of belts.

k. Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.

b. Horsepower and rpm.

c. Volts, phase, and hertz.

d. Full-load amperage and service factor.

e. Sheave make, size in inches, and bore.

f. Center-to-center dimensions of sheave and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.

b. Total system static pressure in inches wg.

c. Fan rpm.

d. Discharge static pressure in inches wg.

e. Filter static-pressure differential in inches wg.

f. Preheat-coil static-pressure differential in inches wg.

g. Cooling-coil static-pressure differential in inches wg.

h. Heating-coil static-pressure differential in inches wg.

i. Outdoor airflow in cfm.

j. Return airflow in cfm.

k. Outdoor-air damper position.

l. Return-air damper position.

m. Vortex damper position.

F. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.

b. Location.

c. Make and type.

d. Model number and size.

e. Manufacturer's serial number.

f. Arrangement and class.

g. Sheave make, size in inches, and bore.

h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.

b. Horsepower and rpm.

c. Volts, phase, and hertz.

d. Full-load amperage and service factor.

e. Sheave make, size in inches, and bore.

f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.

b. Total system static pressure in inches wg.

c. Fan rpm.

d. Discharge static pressure in inches wg.

e. Suction static pressure in inches wg.

G. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.

b. Location and zone.

c. Traverse air temperature in deg F.

d. Duct static pressure in inches wg.

e. Duct size in inches.

f. Duct area in sq. ft..

g. Indicated airflow rate in cfm.

h. Indicated velocity in fpm.

i. Actual airflow rate in cfm.

j. Actual average velocity in fpm.

k. Barometric pressure in psig.

H. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.

b. Serial number.

c. Application.

d. Dates of use.

e. Dates of calibration.

3.08 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Owner.

B. Owner shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.

2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.

3. If the second verification also fails, design professional may contact AABC Headquarters regarding the AABC National Performance Guaranty.

F. Prepare test and inspection reports.

3.09 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 23 31 16
NONMETAL DUCTS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fibrous-glass ducts and fittings.

B. Related Sections

1. Section 23 05 93 – Testing , Adjusting, and Balancing for HVAC, for testing, adjusting, and balancing requirements for nonmetal ducts.

2. Section 23 33 00 – Air Duct Accessories, for dampers, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.02 PERFORMANCE REQUIREMENTS

A. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.03 ACTION SUBMITTALS

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

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.

2. Duct layout indicating sizes and pressure classes.

3. Elevation of top of ducts.

4. Dimensions of main duct runs from building grid lines.

5. Fittings.

6. Reinforcement and spacing.

7. Seam and joint construction.

8. Penetrations through fire-rated and other partitions.

9. Equipment installation based on equipment being used on Project.

10. Hangers and supports, including methods for duct and building attachment and vibration isolation.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.

2. Suspended ceiling components.

3. Structural members to which duct will be attached.

4. Size and location of initial access modules for acoustical tile.

5. Penetrations of smoke barriers and fire-rated construction.

6. Items penetrating finished ceiling including the following:

a. Lighting fixtures.

b. Air outlets and inlets.

c. Access panels.

1.05 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

C. NFPA Compliance:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."

2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 – PRODUCTS

2.01 FIBROUS-GLASS DUCTS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Johns Manville; a Berkshire Hathaway company;
2. Knauf Insulation;
3. Owens Corning;
4. Or approved equal.

B. Fibrous-Glass Duct Materials: Resin-bonded fiberglass, faced on the outside surface with fire-resistive FSK vapor retarder and with a smooth fiberglass mat finish on the air-side surface.

1. Duct Board: Factory molded into rectangular boards.
2. Temperature Limits: 40 to 250 deg F inside ducts; 150 deg F ambient temperature surrounding ducts.
3. Maximum Thermal Conductivity: 0.24 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
4. Moisture Absorption: Not exceeding 5 percent by weight at 120 deg F and 95 percent relative humidity for 96 hours when tested according to ASTM C 1104/C 1104M.
5. Permeability: 0.02 perms maximum when tested according to ASTM E 96/E 96M, Procedure A.
6. Antimicrobial Agent: Compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
7. Noise-Reduction Coefficient: 0.65 minimum when tested according to ASTM C 423, Mounting A.
8. Required Markings: EI rating, UL label, and other markings required by UL 181 on each full sheet of duct board.

C. Closure Materials:

1. Pressure-Sensitive Tape: Comply with UL 181A; imprinted by the manufacturer with the coding "181A-P," the manufacturer's name, and a date code.
    a. Tape: Aluminum foil-scrim tape imprinted with listing information.
    b. Minimum Tape Width: 2-1/2 inches; 3 inches for duct board thicker than 1 inch.
    c. Staples: 1/2-inch outward clinching, 2 inches o.c. in tabs, one tab per joint.
    d. Water resistant.
    e. Mold and mildew resistant.
2. Heat-Activated Tape: Comply with UL 181A; imprinted by the manufacturer with the coding "181A-H," the manufacturer's name, and a date code.
    a. Tape: Aluminum foil-scrim tape imprinted with listing information.
    b. Minimum Tape Width: 3 inches.
    c. Heat-Sensitive Imprint: Printed indicator on tape to show proper heating during application has been achieved.
    d. Water resistant.
    e. Mold and mildew resistant.
3. Two-Part Tape Sealing System: Comply with UL 181A; imprinted by the manufacturer with the coding "181A-M," the manufacturer's name, and a date code.
    a. Tape: Woven glass fiber impregnated with mineral gypsum.
    b. Minimum Tape Width: 3 inches.
    c. Sealant: Modified styrene acrylic.
    d. Water resistant.
    e. Mold and mildew resistant.

D. Fabrication:

1. Select joints, seams, transitions, elbows, and branch connections and fabricate according to SMACNA's "Fibrous Glass Duct Construction Standards," Chapter 2, "Specifications and Closure," and Chapter 4, "Fittings and Connections."

2. Fabricate 90-degree mitered elbows to include turning vanes.

3. Reinforcements: Comply with requirements in SMACNA's "Fibrous Glass Duct Construction Standards," Chapter 5, "Reinforcement" for channel- and tie-rod reinforcement materials, spacing, and fabrication.

2.02 HANGERS AND SUPPORTS

A. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

C. Steel Cables: ASTM A 492, stainless steel with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

D. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

E. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

PART 3 – EXECUTION

3.01 DUCT INSTALLATION

A. Install ducts with fewest possible joints.

B. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

C. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

D. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

E. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges. Overlap openings on four sides by at least 1-1/2 inches.

F. Protect duct interiors from the moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

G. Install fibrous-glass ducts and fittings to comply with SMACNA's "Fibrous Glass Duct Construction Standards."

3.02 HANGER AND SUPPORT INSTALLATION

A. Install hangers and supports for fibrous-glass ducts and fittings to comply with SMACNA's "Fibrous Glass Duct Construction Standards," Chapter 6, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Install concrete inserts before placing concrete.

2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.

4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.03 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch duct as recommended by duct manufacturer. Comply with Section 23 33 00 – Air Duct Accessories for access panels and doors.

2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.

3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.

2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).

2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.

4. Coils and related components.

5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.

6. Supply-air ducts, dampers, actuators, and turning vanes.

7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.

2. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of ducts or duct accessories.

3. Clean fibrous-glass duct with HEPA vacuuming equipment; do not permit duct to get wet. Replace fibrous-glass duct that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.

4. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

5. Provide drainage and cleanup for wash-down procedures.

6. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.04 START UP

A. Air Balance: Comply with requirements in Section 23 05 93 – Testing, Adjusting, and Balancing for HVAC.

3.05 DUCT SCHEDULE

A. Indoor Ducts and Fittings:

1. Fibrous-Glass Rectangular Ducts and Fittings:

a. Minimum Flexural Rigidity: EI-475.

b. Minimum Board Thickness: 1 inch.

END OF SECTION

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Manual volume dampers.
2. Flange connectors.
3. Turning vanes.
4. Duct-mounted access doors.
5. Flexible connectors.
6. Duct accessory hardware.

B. Related Sections:

1. Section 23 05 53 – Identification for HVAC Piping and Equipment

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.03 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 – PRODUCTS

2.01 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.02 MATERIALS

A. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

B. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

C. Reinforcement Shapes and Plates: Aluminum reinforcement where installed on aluminum sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

D. Tie Rods: Aluminum, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.03 MANUAL VOLUME DAMPERS

A. Standard, Aluminum, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Nailor Industries Inc;

    b. Ruskin Company;

    c. Or approved equal.

2. Standard leakage rating, with linkage outside airstream.

3. Suitable for horizontal or vertical applications.

4. Frames: Hat-shaped, 0.10-inch-thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

    a. Multiple or single blade.

    b. Parallel- or opposed-blade design.

    c. Stiffen damper blades for stability.

    d. Roll-Formed Aluminum Blades: 0.10-inch-thick aluminum sheet.

    e. Extruded-Aluminum Blades: 0.050-inch-thick extruded aluminum.

6. Blade Axles: Stainless steel.

7. Bearings:

   a. Stainless-steel sleeve.

   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Aluminum.

B. Jackshaft:

1. Size: 1-inch diameter.

2. Material: Stainless steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.

2. Include center hole to suit damper operating-rod size.

3. Include elevated platform for insulated duct mounting.

2.04 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc;

2. Or approved equal.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Aluminum.

D. Gage and Shape: Match connecting ductwork.

2.05 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc;

2. Or approved equal.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of aluminum; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

E. Vane Construction: Double wall.

2.06 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Aire Technologies;

2. Ductmate Industries, Inc;

3. Or approved equal.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

a. Double wall, rectangular.

b. Aluminum sheet metal with insulation fill and thickness as indicated for duct pressure class.

c. Vision panel.

d. Hinges and Latches: 1-by-1-inchbutt or piano hinge and cam latches.

e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Aluminum sheet, with bend-over tabs and foam gaskets.

3. Number of Hinges and Locks:

a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.

b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.

c. Access Doors up to 24 by 48 Inches: Continuous and two compression latches.

d. Access Doors Larger Than 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.

C. Pressure Relief Access Door:

1. Door and Frame Material: Aluminum

2. Door: Single wall with metal thickness applicable for duct pressure class.

3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.

4. Factory set at 3.0- to 8.0-inch wg.

5. Doors close when pressures are within set-point range.

6. Hinge: Continuous piano.

7. Latches: Cam.

8. Seal: Neoprene or foam rubber.

9. Insulation Fill: 1-inch-thick, fibrous-glass or polystyrene-foam board.

2.07 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc;

2. Or approved equal.

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 0.0528-inch carbon steel.

D. Fasteners: Aluminum. Panel fasteners shall not penetrate duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.08 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc;

2. Or approved equal.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..

2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.

3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd.

2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.

3. Service Temperature: Minus 50 to plus 250 deg F.

2.09 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use aluminum accessories in aluminum ducts.

C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install aluminum volume dampers in aluminum ducts where noted.

D. Set dampers to fully open position before testing, adjusting, and balancing.

E. Install test holes at fan inlets and outlets and elsewhere as indicated.

F. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.

2. Upstream from duct filters.

3. At outdoor-air intakes and mixed-air plenums.

4. At drain pans and seals.

5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.

6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.

7. At each change in direction and at maximum 50-foot spacing.

8. Upstream from turning vanes.

9. Upstream or downstream from duct silencers.

10. Control devices requiring inspection.

11. Elsewhere as indicated.

G. Install access doors with swing against duct static pressure.

H. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.

2. Two-Hand Access: 12 by 6 inches.

3. Head and Hand Access: 18 by 10 inches.

4. Head and Shoulders Access: 21 by 14 inches.

5. Body Access: 25 by 14 inches.

6. Body plus Ladder Access: 25 by 17 inches.

I. Label access doors according to Section 23 05 53 – Identification for HVAC Piping and Equipment to indicate the purpose of access door.

J. Install flexible connectors to connect ducts to equipment.

K. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

L. Install duct test holes where required for testing and balancing purposes.

3.02 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.

2. Inspect locations of access doors and verify that purpose of access door can be performed.

3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.

4. Inspect turning vanes for proper and secure installation.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 23 34 16

FANS

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: For each product.

1. Roof Mounted Mixed-Flow Fans
2. Wall Fans

B. Related Sections:

1. Section 23 05 53 – Identification for HVAC Piping and Equipment
2. Section 23 05 93 – Testing, Adjusting, and Balancing For HVAC
3. Section 23 33 00 – Air Duct Accessories

1.2 ACTION SUBMITTALS

A. Product Data:

1. Include rated capacities, furnished specialties, and accessories for each fan.
2. Certified fan performance curves with system operating conditions indicated.
3. Certified fan sound-power ratings.
4. Motor ratings and electrical characteristics, plus motor and electrical accessories.
5. Material thickness and finishes, including color charts.
6. Dampers, including housings, linkages, and operators.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show fan room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For centrifugal fans to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Belts: One set(s) for each belt-driven unit.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Fans shall be fully assembled and mounted on the skid at the factory. Equipment shall be crated and delivered to protect against damage during shipping. Flange faces shall be protected from damage. All openings shall be covered to prevent entrance of dirt, water and debris.

B. Properly protect all parts so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and until the units and equipment are ready for operation.

C. Properly protect finished iron or steel surfaces to prevent rust and corrosion.

D. Acceptance at Site: Equipment arriving at the site in a damaged condition shall be rejected.

PART 2 – PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AMCA Compliance: Comply with AMCA performance requirements and bear the AMCA-Certified Ratings Seal.

2.2 ROOF MOUNTED MIXED-FLOW FANS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. LOREN COOK;

2. Greenheck;

3. Aerovent; a division of Twin City Fan Companies, Ltd;

4. Or approved equal.

B. Description:

1. Factory-fabricated, -assembled, -tested, and -finished, belt-driven mixed-flow fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.

2. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.

3. Factory-installed and -wired disconnect switch.

C. Housings:

1. Minimum 14 gauge steel

2. Spun aluminum top cap constructed of a minimum .063 thick marine alloy aluminum.

3. Steel fan components shall be coated with a baked polyester powder coating. Paint must exceed 1,000 hour slat spray under ASTM B117 test method.

D. Wheels:

1. Steel, non-overloading, high efficiency mixed-flow type.

E. Shafts:

1. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.

2. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.

3. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

F. Grease-Lubricated Shaft Bearings:

1. Minimum L 50 life of 200,000 hours

2. Heavy-duty, self aligning ball or roller type and relubricated for continuous service.

3. Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.

G. Belt Drives:

1. Factory mounted, with adjustable alignment and belt tensioning.

2. Service Factor Based on Fan Motor Size: 1.5.

3. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.

4. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.

5. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.

6. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

7. Motor Mount: Adjustable for belt tensioning.

H. Accessories:

1. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.

2. All fan hardware shall be stainless steel.

3. Scroll Drain Connection: NPS 1 steel pipe coupling welded to low point of fan scroll.

4. Companion Flanges: Rolled flanges for duct connections of same material as housing.

5. Variable Inlet Vanes: With blades supported at both ends with two permanently lubricated bearings of same material as housing. Variable mechanism terminating in single control lever with control shaft for double-width fans.

6. Discharge Dampers: Assembly with parallel blades constructed of two plates formed around and to shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.

7. Inlet Screens: Grid screen of same material as housing.

8. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.

9. Spark-Resistant Construction: AMCA 99.

10. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.

11. Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.

2.3 WALL FANS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. LOREN COOK;

2. Greenheck;

3. Aerovent; a division of Twin City Fan Companies, Ltd;

4. Or approved equal.

B. Description:

1. Factory-fabricated, -assembled, -tested, and -finished, wall mounted, direct driven propeller fan.

2. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.

C. Construction:

1. Fan shall be bolted and welded construction utilizing corrosion resistant fasteners.

2. Motor shall be mounted on a 14 gauge steel power assembly.

3. Power assembly shall be bolted to a 14 gauge steel wall panel and welded to an integral venturi.

D. Coating:

1. All steel fan components shall be provided with a electrostatically applied, baked polyester powder coating. Each component shall be subject to a five stage environmentally friendly wash system, followed by a minimum 2 mil thick baked powder finish. Paint must exceed 1,000 hour salt spray under ASTM B117 test method.

E. Propeller:

1. Propeller shall be extruded aluminum airfoil design with cast aluminum hub. Propeller shall be balanced in accordance with AMCA Standard 204-05, Balance Quality and Vibration Levels for Fans.

F. Motor:

1. Motor shall be NEMA design B with class B insulation rated for continuous duty and furnished at the specified voltage, phase and enclosure.

2.4 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data."

B. Factory test fans according to AMCA 300, “Reverberant Room Method for Sound Testing of Fans.”

C. Label fans with the AMCA-Certified Ratings Seal.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install fans level and plumb.

B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

D. Unit Support: Install centrifugal fans level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure units to structural support with anchor bolts.

E. Install units with clearances for service and maintenance.

F. Label fans according to requirements specified in Section 23 05 53 – Identification for HVAC Piping and Equipment.

3.2 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 23 33 00 – Air Duct Accessories.

B. Install ducts adjacent to fans to allow service and maintenance.

3.3 FIELD QUALITY CONTROL

A. Perform the following 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, align and adjust belts, and install belt guards.

5. Adjust belt tension.

6. Adjust damper linkages for proper damper operation.

7. Verify lubrication for bearings and other moving parts.

8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.

9. See Section 23 05 93 – Testing, Adjusting, and Balancing For HVAC for testing, adjusting, and balancing procedures.

10. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION

SECTION 23 37 13
AIR INLETS AND OUTLETS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fixed face registers and grilles.

B. Related Sections:

1. Section 23 33 00 – Air Duct Accessories, for fire and smoke dampers and volume-control dampers not integral to registers and grilles.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 – PRODUCTS

2.01 REGISTERS

A. Fixed Face Register:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. A-J Manufacturing Co., Inc.;

b. Price Industries;

c. Titus, a division of Air System Components; Johnson Controls, Inc.;

d. Or approved equal.

2. Material: Aluminum.

3. Finish: Baked enamel, white.

4. Face Blade Arrangement: Horizontal spaced 3/4 inch apart.

5. Face Arrangement: Perforated core.

6. Core Construction: Integral.

7. Frame: 1-1/4 inches wide.

8. Mounting Frame: Filter.

9. Mounting: Countersunk screw.

10. Damper Type: Adjustable opposed blade.

11. Accessory: Filter.

2.02 GRILLES

A. Fixed Face Grille:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. A-J Manufacturing Co., Inc.;

b. Price Industries;

c. Titus, a division of Air System Components; Johnson Controls, Inc.;

d. Or approved equal.

2. Material: Aluminum.

3. Finish: Baked enamel, white.

4. Face Blade Arrangement: Horizontal; spaced 3/4 inch apart.

5. Face Arrangement: Perforated core.

6. Core Construction: Integral.

7. Frame: 1-1/4 inches wide.

8. Mounting Frame: Filter.

9. Mounting: Countersunk screw.

10. Accessory: Filter.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install registers and grilles level and plumb.

B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.02 ADJUSTING

A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 23 82 39
ELECTRIC UNIT HEATERS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Wall and ceiling heaters with propeller fans and electric-resistance heating coils.

B. Related Sections:

1. Section 26 05 26 – Grounding

2. Section 26 00 10 – Electrical Work

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and details.

2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Include details of anchorages and attachments to structure and to supported equipment.

4. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.

5. Wiring Diagrams: Power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

1.03 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Chromalox, Inc;
2. INDEECO;
3. QMark; Marley Engineered Products;
4. Or approved equal.

2.02 DESCRIPTION

A. Assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.

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.

2.03 CABINET

A. Industrial grade, corrosion-resistant cabinet fabricated from polyester powder-coated, 14 gauge steel.

2.04 COIL

A. Steel tube core with integral aluminum fins. Nontoxic, inhibited, propylene glycol heat transfer fluid shall be used that provides freeze protection down to -49° F (-45°C). A Pressure relief plug shall be utilized to provide overpressure protection. The heat exchanger shall include industrial grade electric heating elements.

2.05 FAN AND MOTOR

A. Fan: Aluminum propeller directly connected to motor.

B. Motor: Permanently lubricated, multispeed.

2.06 CONTROLS

A. Controls: Unit-mounted thermostat.

B. Electrical Connection: Factory wire motors and controls for a single field connection.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install wall and ceiling unit heaters to comply with NFPA 90A.

B. Install wall and ceiling unit heaters level and plumb.

C. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

D. Ground equipment according to Section 26 05 26 – Grounding.

E. Connect wiring according to Section 26 00 10 – Electrical Work.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 26 00 10

ELECTRICAL WORK

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. General work description and requirements for electrical work included in this contract.
2. Raceways, fittings, and boxes.
3. Conductors and accessories.
4. Wiring devices.
5. Grounding.
6. Panelboards.
7. Disconnect and safety switches.
8. Nameplates and labels.
9. Spare devices.

B. Related Sections:

1. Section 01 33 00 – Submittal Procedures
2. Section 01 77 19 – Closeout Requirements
3. Section 26 05 26 – Grounding
4. Section 26 27 16 – Control Panels and Enclosures

1.02 GENERAL REQUIREMENTS

A. All work shall be subject to applicable Sections of these specifications, not necessarily the aforementioned related Sections.

B. Examination of Premises

1. Before submitting a proposal, the Contractor shall examine all drawings and specifications relating to work of all trades to determine scope and relation to other work.

2. Ascertain access to site, available storage, and delivery facilities.

3. Before commencing work, verify all governing dimensions and examine all adjacent work at site and/or buildings.

4. Some equipment or material items may be special order items having long order times and shall be ordered well in advance of installation. Unavailability due to long lead times or special orders is not an excuse for not providing the specified items.

1.03 SCOPE OF WORK

A. The principal items of electrical work include, but are not necessarily limited to, the following:

1. Provide all electrical power, lighting, control, instrumentation wiring, communications systems, including exposed and concealed raceway systems, conductors, cables, fittings, special control, wiring devices, distribution equipment, motor control center, various types of motor starters, overcurrent protection, terminations, connections, and interconnections, and all related appurtenances to provide a complete and operating electrical system.

2. Provide all system and equipment grounding in conformance with the requirements of these specifications and the National Electrical Code (NEC).

3. Provide electrical labels, signs, and nameplates per this Section.

4. Install all electrical equipment, conduit, wire, conductors, cable, connections, etc., required for complete and operating systems.

5. Coordinate work with the work of others for timely completion of the work of this contract.

6. Repair, fill and/or patch surfaces of all building components including walls, floors, ceilings, and roofs damaged or left open or bare as a result of the electrical work.

7. Have an Owner-approved third-party inspecting agency inspect electrical installation. Submit a final certificate approving all work to the Engineer prior to final acceptance of the electrical work.

8. See Section 01 77 19 – Closeout Requirements for additional requirements for record drawings, operation and maintenance manual, final testing and inspection, and guarantees and warranties.

9. Provide all materials, equipment, and labor required for complete and operating electrical power and instrumentation systems.

1.04 CODES AND STANDARDS

A. Reference to various codes and standards are a minimum installation requirements standard. In case(s) of discrepancy between the Contract Documents and the NEC, the stricter requirement shall apply.

B. All work, equipment, and materials furnished shall conform with the existing rules, requirements, and specifications of the Insurance Rating Organization having jurisdiction; the NEC; National Electric Manufacturer's Association (NEMA); Underwriters Laboratories (U.L.); and the respective utilities.

C. All material and equipment shall bear the inspection labels of Underwriters Laboratories, unless otherwise allowed by the Engineer in writing and if the material and equipment is of the class inspected by said laboratories. All labeling shall be for the intended usage.

D. The Contractor shall be held responsible for adherence to all rules, requirements, and specifications as set forth above. Any additional work or material necessary for adherence will not be allowed as an extra, but shall be included in the bid price. Ignorance of any rule, requirement, or specification shall not be allowed as an excuse for non-conformity. Acceptance by the Owner or Engineer does not relieve the Contractor from the expense involved for the correction of any errors which may exist in the drawings submitted or in the satisfactory operation of any equipment.

1.05 SUBMITTALS

A. Submit shop drawings under provisions of Section 01 33 00 – Submittal Procedures.

B. The Engineer's approval shall be obtained for all equipment and material for which shop drawings are required before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.

C. Provide submittals for all conduit, wire, cable, boxes other than device boxes, enclosures, fittings, hangers, supports, outlets, disconnect switches, lighting fixtures, ballasts, starters, overloads, overcurrent devices, panelboards, control and starter panels, VFDs, seal-offs, and all other electrical equipment as listed in other Sections.

D. Provide submittals for all Division 26 and Division 40 electrical and instrumentation work.

E. Conduit Layout Submittal: Provide submittals for all interior and exterior conduit layout. Submittals shall be 11x17 or 24x36, scaled drawings indicating conduit routing, elevations, quantity and type of conduits, quantity and type of wires, and conduit source and destination. All pull and junction boxes shall also be noted on the drawings. Conduits shall be tagged/labeled on the drawings and likewise labeled during installation.

1.06 RECORD DRAWINGS

A. In addition to the requirements of Section 01 77 19 – Closeout Requirements, regarding record drawings, prepare and submit marked-up field record drawings, which shall include all addenda items and changes made during construction, to the Engineer prior to final acceptance. Additionally, submit record drawings consisting of the following three types of drawings:

1. Elementary or Schematic Diagrams - All control schematics and elementary diagrams. Those constructed as shown on Contract Drawings need only be verified on the marked-up field set. For those that changed, submit preliminary revised schematic and elementary diagrams for the Engineer's review. Once reviewed and approved, these diagrams shall be drafted on 24-inch by 36-inch sheets and added as "__A" sheets.

2. Block Diagrams - Prepare and submit fully labeled block diagrams, showing all point-to-point connections giving conduit size and fill (each conductor number, size, and color listed) showing all junctions boxes, pullboxes, panels, etc., together with terminal numbers at all conductor terminations. Each wire shall be assigned a unique identification tag, reflecting the label installed in the field. Initially, hand sketches on 8-1/2-inch by 11-inch sheets can be submitted for review. Once reviewed and approved, these designs shall be drafted on 24-inch by 36-inch sheets with suitable title block data. Block diagrams are to be updated to reflect all final connections (connections labeled) or other changes. When there is more than one sheet of block diagrams, an index shall be included to indicate on which sheet the respective pieces of equipment can be found. See sample attached to end of this Section.

3. Contractor's As-built Drawings - Provide one 24-inch by 36-inch copies of electrical as-built drawings of the Contract Drawings with all field notes and comments to illustrate actual construction conditions. As-built drawings shall include all addenda items issued during bidding and all other changes to the documents that occurred during construction. Drawing to be titled "Contractor's As-built Drawing, Prepared by: (name of Contactor, Date Issued".

4. Electronic copies of the as-bid set of Contract Drawings will be provided to the Contractor for use in record drawing preparation. Contractor shall modify the as-bid set of drawings for record drawings. All drawings shall be prepared using AutoCAD drafting; no paste-on information will be allowed.

B. Submit a final record drawing copy on 24-inch by 36-inch bond paper for the Engineer's review.

C. "A" drawings shall be prepared (24-inch by 36-inch) showing all concealed conduit including ductbanks that cannot be shown clearly on the marked-up field set. All

underground conduit routings and ductbanks shall be dimensioned from aboveground structures. All manholes, handholes, pullboxes, and bends without structures shall have at least two ties.

D. Once final approval of the drawings with corrections is provided to the Contractor, all final drawings shall be provided on a compact disc and produced using the computer-aided drafting system, AutoCAD 2018, as a minimum. Later revisions shall be saved as this version.

1.07 EQUIPMENT PROTECTION

A. Equipment and material shall be delivered to the site in new, unused condition in original packaging. Contractor shall be responsible to store equipment and protect against damage, theft, dirt, moisture and temperature extremes.

B. All motor control centers, programmable logic controllers, variable frequency drive, and instrumentation to be transported under this contract shall be shipped to and from the site in enclosed, weathertight, sealed containers in a manner designed to protect the units against damaging stress caused by sudden acceleration or deceleration. An indicating meter, such as “Drop-N-Tell,” designed to indicate any sudden impacts that exceed the unit’s rating shall be shipped with and fixed to each assembly or its packing crate. Upon arrival of each shipment at the project site, the meter shall be examined in the presence of representatives of the Engineer, the Contractor, and the equipment manufacturer. If the acceleration indicates the package exceeded the limits of the meter, the assembly or subassembly shall be dismantled and completely inspected. All damage shall be corrected before the equipment is incorporated into the work. The Contractor shall bear all cost arising out of dismantling, inspection, repair, and reassembly, including engineering costs. The meters shall be sized for three times the weight of the packaged item.

C. During the installation of equipment, controls, controllers, circuit protective devices, etc., these items shall be protected against entry of foreign matter and be vacuum cleaned both inside and outside before testing and operation.

D. Damaged equipment, as determined by the Owner and/or the Engineer, shall either be repaired to new condition or replaced with new equipment.

E. Painted surfaces shall be protected with factory installed removable heavy craft paper, sheet vinyl or similar protective cover.

1.08 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. The locations of equipment, fixtures, outlets and similar devices shown on the Contract Drawings are approximate only. Equipment shall be installed as close as practical to locations shown on the Drawings. Where Contractor supplied equipment sizes differ

from that anticipated on the Drawings, the Contractor shall prepare and submit to the Engineer new “to scale” layouts showing new equipment locations for approval.

B. Equipment Provided Under Other Divisions

1. Reasonable effort has been made to show the actual locations and sizes of the equipment to be provided under other Sections of the specifications and installed by other trades for the project. These locations shall be considered approximate, but suitable for preparation of the Contractor’s bid. These locations are not necessarily final locations. Contractor shall verify equipment size and location with the installing trades before rough in and obtain the applicable shop drawing information to enable the electrical trade(s) to furnish and install electrical service to the equipment, at no cost to the Owner.

2. The Contractor and/or the electrical installer(s) shall coordinate the exact locations of all equipment, receptacles, box-outs, sleeves and similar items required for the completion of electrical work with the structural, architectural, mechanical or other work.

3. The wiring configuration of equipment provided by other divisions will vary, depending on the manufacturer used. Specific wire connections to equipment provided by other divisions are not shown in these documents. The electrical installer(s) shall coordinate the wire connections with the division supplying the equipment.

4. No additional compensation will be made for relocations, reconnections or additional work required as a result of the failure of the Contractor and/or the electrical installer(s) to fully coordinate the work of all trades.

C. Inaccessible Equipment

1. Where the Engineer determines that the Contractor or his subcontractors has installed equipment that is not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled as required by the Engineer at the Contractor’s expense.

2. “Conveniently accessible” is defined as reachable without the use of ladders, without climbing over or crawling under obstacles such as equipment, structures, piping and ductwork. Equipment shall be installed at the heights as specified in other Sections of these specifications, except any readout devices shall be installed so that the centerline of the readout is 5 feet 0 inches above finish floor.

D. Equipment and Material - Equipment and material shall be designed to assure satisfactory operation and operating life for environmental conditions where being installed. These specifications, the NEC, and other code requirements shall apply to the

installation in areas requiring special protection; i.e., hazardous, wet or corrosive area/location, and weatherproof construction.

E. Classified Areas

1. General - Enclosures for classified areas shall be as specified in Section 26 27 16 – Control Panels and Enclosures.

2. Hazardous Areas

a. In the areas designated as hazardous and where explosion-proof work is shown or specified, all work shall meet the requirements of the NEC for the classification of that location.

b. Equipment enclosures shall be approved for use in the atmosphere of the area in which they are installed, i.e., Class I, Division 1, Group D; Class I, Division 2, Group D atmospheres.

3. Wet and Outdoor Locations - Where installed outdoors or in areas designated as wet locations, all work shall meet the requirements of these specifications and of the NEC for wet locations.

4. Corrosive Areas - All equipment shall be corrosion resistant in areas so designated unless specified otherwise.

F. Rigging and Moving Equipment - Contractor and his subcontractors shall exercise extreme care and caution in moving and installing equipment. Skilled riggers shall be employed to move any equipment over 300 lbs. or of sufficient bulk. Proper falsework, skids, blocking, runways, supports of new or existing work, or other devices shall be employed when moving or placing equipment.

G. Diagrammatic Drawings

1. Circuit diagrams shown are diagrammatic and functional only and are not intended to show exact circuit or wiring layouts, number of fittings or other installation details. The Contractor shall furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting and other electrical systems shown.

2. Circuits beyond their pushbutton and control device and conduits containing lighting circuits beyond panelboards are not always shown or scheduled.

3. The number of conductors shown is not necessarily the correct number required. Contractor shall install as many conductors as are required for the complete and satisfactory operation of all systems.

H. Conductor Sizing - Conductor sizes are shown for equipment branch circuits extending less than 100 feet from power source. Refer to schedule in this Section for sizing conductors on circuits more than 100 feet long. Conduit sizes shall change accordingly. Contractor shall include this cost in his bid.

PART 2 – MATERIALS

2.01 RACEWAYS, FITTINGS AND BOXES

A. Raceways

1. Rigid Galvanized Steel Conduit (RGS)

a. Application - Unless otherwise indicated on the Contract Drawings or under this Specification Section, all wiring shall be run in RGS conduit.

b. Description - Hot dipped galvanized rigid steel conduit, shall conform to ASA C80-1.

c. Manufacturers:

1) Youngstown;

2) Pittsburgh Standard (RobRoy Industries);

3) Triangle;

4) Or approved equal.

2. Type E – PVC-Coated Rigid Steel Conduit with an Interior Urethane Coating

a. Application - This conduit shall be used in the following areas: hazardous, wet, outdoor and corrosive areas.

b. Description – PVC-coated, rigid steel conduit. Shall conform to Federal Specification WWC-581d and be coated with a heat polymerizing adhesive prior to plastic coating. PVC coating shall be applied by plastisol method. The interior coating shall be a factory-applied two-part 2 mil thick chemically cured hot dipped urethane coating. The conduit shall conform to NEMA Standard No. RNI-1986.

c. Manufacturers:

1) RobRoy Industries;

2) OCAL;

3) Or approved equal.

3. Type G – Liquid-tight Flexible Conduit

a. Application – For use in wet areas as final connection to heating and ventilating equipment, motors, and other vibrating equipment. Not for use in Class I Division 2 locations.

b. Description – Liquid-tight, flexible conduit shall be flexible galvanized steel case with extruded PVC jacket.

c. Manufacturers:

1) Anonconda;

2) Triangle;

3) Keystone;

4) O.Z. Gedney;

5) Or approved equal.

4. Type H – Explosion-proof, Flexible Conduit

a. Application - For use in hazardous areas, Class 1 Division 1 and 2, as final connection to lighting, heating and ventilating equipment, motors, and other vibrating equipment.

b. Description – Explosion-proof, flexible conduit shall be flexible core with bronze braid covering and steel end fittings.

c. Manufacturers:

1) Crouse-Hinds;

2) Appleton;

3) Killark;

4) Or approved equal.

B. Conduit Fittings

1. All Fittings – Cast-type material and coatings shall match conduit system it is to be used with.

2. Covers shall be of the same material as the fittings to which they are attached. Provide gaskets for exterior use and for interior wet areas.

C. Expansion Deflection Fittings

1. Material shall match conduit system it is to be used with, designed for 4-inch movement. Fitting shall be provided at ends of all ductbanks and where conduit runs cross building expansion joints.

2. Coupling shall compensate for the following movements:

a. Axial expansion or contraction.

b. Angular misalignment.

c. Parallel misalignment.

D. Access Fitting and Pulling Fitting - Of the same construction as conduit fittings. Provide cover gasket for interior wet locations and exterior areas. For corrosive areas, use PVC or fiberglass boxes.

E. Boxes

1. Outlet and Device - Of the same construction as conduit fittings. Provide cover gasket in wet locations.

2. Junction and Pullboxes - Of the same construction as conduit fittings. Up to 100 cubic inches. Larger interior non-classified area boxes shall be galvanized with hinged covers. Exterior and interior wet, non-corrosive areas shall be stainless steel. Provide cover gasket in wet or corrosive locations. Provide terminal strips for joining conductors in boxes over 100 cubic inches.

F. Elbows - Factory made by same manufacturer as couplings or conduit. Material to match conduit system it is to be used with.

G. Miscellaneous

1. Nipples, Locknuts, and Bushings - Factory made; material to match conduit system it is to be used with.

H. Conduit and Core Hole Sealing – Double (on both sides of the wall) Mechanical link type with elastomeric links joined by stainless steel bolts which also serve to expand the seal. Shall be fire rated when used in fire walls. Manufacturer - Thunderline Corporation, Model “Linkseal”, or approved equal.

2.02 CONDUCTORS AND ACCESSORIES

A. Conductors: Application - Material – Manufacturers

1. Multi-Conductor Power and Control Cable

a. Application - For use in place of building wire and cable when powering three-phase equipment or for consolidating the number of power and control cables between two locations.

b. Description - Multi-conductor, Type TC cable.

1) Conductor - Stranded copper.

2) Insulation Voltage Rating - 600 volts.

3) Insulation Material - PVC with phase indicators for individual conductors and nylon or PVC for overall jacket.

c. Manufacturers:

1) Anixter - Model 3G;

2) Cablec - Model AP14321;

3) Belden – Tray cable;

4) Or approved equal.

2. Building Wire and Cable

a. Application - For general use for all conductor applications unless specifically called out otherwise. Not for use as instrumentation cable or in manufactured control panels, service entrance cable, and submersible cable.

b. Description - Single conductor insulated wire type as indicated below.

1) Conductor - Stranded copper only.

2) Insulation Voltage Rating - 600 volts.

3) Insulation Type - Type XHHW for feeders, XHHW for branch circuits.

4) Insulation Material - PVC or thermoplastic with cross-linked polymer nylon overall jacket.

c. Manufacturers:

1) Southwire;

2) General Cable;

3) Or approved equal.

3. Twisted Instrumentation Cable (Interior)

a. Application - For signal or instrumentation wiring and use where called for on Contract Drawings.

b. Description - Single or multi, twisted pair and twisted triad cable with overall shield.

1) Conductor - Stranded copper, Size 16 AWG.

2) Insulation Voltage Rating - 600 volts.

3) Insulation Material - Color coded PVC for individual conductors and nylon or overall jacket.

4) Shielding – 100 percent overall aluminum or aluminum/polyester foil.

5) Drain - Tinned copper wire.

c. Manufacturers

1) Alpha - Model 2471 (2421);

2) Belden - Model 8719 (8760);

3) Or approved equal.

4. Twisted Instrumentation Cable (Exterior and Ductbanks)

a. Description - Single and multi-twisted pair cable with overall shield.

b. Conductor - Stranded copper, size 16 AWG.

c. Insulation Voltage Rating - 600 volts.

d. Insulation - PVC.

e. Shielding, Single Pair - Aluminum/polyester tape.

f. Drain - Tinned copper drain wire.

g. Overall Jacket - Nylon.

h. Manufacturers:

1) Okonite Company - Type P-OS, Model 264;

2) Belden Model 9342;

3) General Cable BICC, No. 125986;

4) Or approved equal.

5. Telecommunication Cable (for Interior Use)

a. Application - For use where called for on Contract Drawings.

b. Description - Multi-conductor cable, insulated and twisted into pairs.

1) Conductor - Solid copper, minimum Size 24.

2) Insulation Material - Color-coded PVC for individual conductors and PVC for overall jacket.

3) Rip Cord - If available.

4) Outer Jacket - PVC.

c. Manufacturers:

1) Anixter - Inside wiring, Model CAT 6 Type CMR;

2) Belden – CAT 6, Model 1232A1;

3) General Cable – CAT 6 UTP Type CMR;

4) Or approved equal.

6. Telecommunication Cable for Underground Ductbank Installations

a. Description - Multi-conductor cable. Insulated conductor is twisted into pairs for installation in ductbanks.

b. Conductor - Minimum size No. 24 solid, annealed, bare copper.

c. Insulation – Color-coded, polyethylene or polypropylene.

d. Units - Pairs stranded into units.

e. Cover - Wire bundle covered with non-hyroscopic tape.

f. Sheath - Aluminum shield.

g. Jacket - Polyethylene; marked at foot intervals. Outside plant rated.

h. Manufacturers:

1) Anixter – Type RUS/REA PE-89;

2) General Cable – Type RUS (REA) P-89AL;

3) Or approved equal.

7. Submersible Motor Conductors

a. Description - Submersible, non-hazardous, extra heavy usage.

b. Conductor - Stranded copper.

c. Insulation Voltage Rating - 600 volts.

d. Insulation - EPD and CP or EP (ethylene propylene) with phase indicators.

e. Manufacturers

1) Anixter - Model 4 PC;

2) Okonite;

3) Cable supplied with and as part of the manufacturer’s standard product offering;

4) Or approved equal.

8. Bonding and Grounding Conductors

a. Application - For use as needed to meet the requirements of this specification as shown on the Drawings and the NEC for bonding and grounding.

b. Description - Multi-conductor cable, insulated conductor is twisted into pairs.

1) Conductor - Bare copper wire.

2) Stranding - Solid ASTM B-1 for Sizes No. 8 and smaller. Stranded ASTM B-8 for Sizes No. 6 and larger.

3) Grounding system conductor from inside equipment to grounding rods or plates and under ductbanks shall be tin-plated. Note: This is a special item; order well in advance of installation.

c. Manufacturers:

1) Anixter - Model 1A or 1B;

2) Cablec - Molded “bare and coated copper conductors” listed under Section 7, “Special Purpose Cables.”;

3) Or approved equal.

9. Control Panel Wire

a. Application - For use in all manufactured or custom built control panels.

b. Description - 90 degrees C machine tool wire.

1) Conductor - Minimum Size AWG #16, 19 strand.

2) Insulation - PVC, 2/64-inch for 600 V service.

c. Manufacturers:

1) Carol - Catalog Series 7600;

2) Anixter - Catalog Series 6W;

3) Or approved equal.

10. Multi-Conductor -1000V Flexible Motor Supply Cable (VFD Cable)

a. Application – For use as motor wiring for VFD driven equipment.

b. Description – 90 degrees C AC motor drive, VFD motor cable.

1) Four-conductor, three-stranded tinned copper circuit conductors plus one ground wire with PVC insulation, XLP insulation.

2) Overall foil shield (100 percent coverage) plus tinned copper braid shield (85 percent coverage), tinned copper drain wire.

3) Overall sun and oil-resistant PVC jacket.

4) Manufacturers – Belden Model No. 29502, or approved equal.

B. Wire Terminations and Connectors

1. General

a. Connector material shall be compatible with the wire that it is to be used with.

b. Connectors made of aluminum shall not be used with copper conductors.

c. Connectors listed below are for use with copper wire. Connectors to be used with aluminum wire shall be of the same general type and construction as those listed below, but shall be suitable for use with aluminum conductors.

2. Terminal Block Manufacture

a. Control Wiring

1) Buchanan – Model 0241;

2) Connectron – Model NSS3;

3) Or approved equal.

b. Equipment Power Wiring

1) Buchanan – Model 416;

2) Connectron – Model NC3;

3) Or approved equal.

3. Two-Way Splices

a. Description – Tubular compression type for conductors 1/0 and larger. Rated 600 VAC and uninsulated.

b. Manufacturer

1) Burndy – Model YS-L “Hylink.”;

2) Thomas & Betts – Model 545;

3) 3M Model 10000;

4) Or approved equal.

4. Crimp Connectors

a. Description – For branch circuit connections, other than lighting and receptacle circuits.

b. Manufacturers

1) Ideal – Series 30; Model 410, 411, 412 with Model 415 and 417 insulator.

2) Thomas & Betts – Model PT66M.

3) Or approved equal.

5. Bus or Lug Terminals, Manufacturer – 600 VAC, Crimp Type

a. Burndy – “HYLUG” Catalog, Series YA;

b. Ideal – Catalog Series CCL and CC;

c. Or approved equal.

6. Terminal Strip Connectors

a. Description – For control and instrumentation connections to terminal strips. Locking fork, vinyl, self-insulated, crimp-type connectors or tubular clamp type.

b. Manufacturers

1) Burndy – “VINYLUG” Types TP-LF and BA-EL;

2) Thomas & Betts – Catalog Series 18RA, 14RB, and 10RC;

3) Ideal – Series 83-7;

4) Or approved equal.

7. Wire Nuts

a. For Unclassified Areas – Hexagonal-shaped for use with a nut driver, compact swept-wings, ribbed cap, UL-listed for 600V with temperature rating of 105 degrees C (221 degrees F).

1) Ideal – Models 341 and 342.

2) 3M – Models 212, 312, and 512.

3) Buchanan – Models B-1, B-2, and B-4.

4) Or approved equal.

b. For Wet, Corrosive, and Hazardous Areas – Compact swept-wings, ribbed cap, filled with non-hardening sealant, UL listed for 600V with temperature rating of 105 degrees C (221 degrees F).

1) Ideal – Model DB Plus.

2) Buchanan – Model BTS2 and BTS4.

3) Or approved equal.

8. Bolted Wire Connectors – Mechanical connectors for all combination of copper and aluminum conductors. Connectors shall be of a compact high-strength design, tin-plated copper alloy, two-piece connector, and shall utilize two hex head bolts.

a. Burndy – Model KVSU.

b. Ideal.

c. Ilsco Corp.

d. Or approved equal.

2.03 WIRING DEVICES

A. Wall Switches

1. Types, Manufacturers, and Catalog Numbers (or approved equal)

Contact	P&S	Leviton	G.E.	Hubbell
1-Pole	20AC-1	1221-2	GE5951-1G	1221
2-Pole	20AC-2	1222-2	GE5952-1G	1222
3-Way	20AC-3	1223-2	GE5953-1G	1223
4-Way	20AC-4	1224-2	GE5954-1G	1224
3-Position	1225	--	GE5957-1	1387
Pilot, 1-Pole	20AC-1-RPL	1221-PL	SP121-8G	1221PL
Locator, 1-Pole	PS20AC-1-CSL	1221-LHC	SL122-2G	1221IL

Hazardous Area, Class I, Divisions 1 and 2, 1-pole factory sealed snap switch or manual motor starting switch – Crouse Hinds, Model EDS Series; or Appleton, Model EDS Series with selector switch covers, or approved equal.

B. Receptacles (Note: All receptacles shall be “side wired” style. “Push-in” styles are not acceptable.)

1. Single Convenience Receptacle
    a. Pass & Seymour, Inc. - Model 5361.
    b. Hubbell - Model 5361.
    c. General Electric - Model 4102.
    d. Leviton - Model 5361.
    e. Or approved equal.
2. Duplex Convenience Receptacle (Interior Use Only) - 20 amp, 125 volt.
    a. Pass & Seymour, Inc. - Model 5362.
    b. Hubbell - Model 5362.
    c. General Electric Co. - Model GE5342.
    d. Leviton - Model 5362.
    e. Or approved equal.
3. GFCI Receptacle with Weatherproof In Service Clear Plastic Cover
    a. Pass & Seymour, Inc. - Model 2091-S.
    b. Hubbell - Model GF-5362.
    c. General Electric - Model GFR-5342.
    d. Leviton - Model 6899.
    e. Or approved equal.
4. Dust and Moisture-Resistant Receptacle, Gray Face, Exterior Use
    a. Pass & Seymour, Inc. - Model CR6307.
    b. Or approved equal.
5. Explosion-proof Receptacle, Class I, Division 1, 20 Amp, 125 Volt
    a. Single gang, feed-thru units.
        1) Crouse Hinds - Model ENRC21201.

2) Appleton Electric Company - Model EFSC175-2023.

3) Or approved equal.

b. Single gang, dead-end units.

1) Crouse Hinds - Model ENR21201.

2) Appleton Electric Company - Model EFS175-2023

3) Or approved equal..

C. Verify wall openings are neatly cut and will be completely covered by wall plates.

D. Wall Plates - Install receptacle and switchplates in accordance with the following schedule:

1. Interior, Unclassified

a. Finished Areas - Standard ivory non-metallic.

b. Unfinished

1) Concealed Wiring - Standard non-metallic brown plates.

2) Surface-Mounted Raceway - Standard brown non-metallic receptacle plates. Standard brown non-metallic switchplates.

2. Interior, Wet Areas

a. Non-metallic weatherproof receptacle plate.

b. Stainless steel switchplate.

2.04 GROUNDING

A. Existing ground system shall remain intact. Any portions that are disturbed during construction shall be restored or replaced.

B. Size of grounding and bonding conductors shall be as shown but not smaller than required by the NEC, Articles 250-66 and 250-122.

C. See Section 26 05 26 – Grounding for additional requirements.

2.05 PANELBOARDS

A. General

1. Interiors

    a. All interiors shall be completely factory assembled.

    b. Neutral bars to be full size and insulated. Neutral bussing to have suitable lugs for each feeder. In subfeed panels, neutral shall be isolated from ground.

    c. Provide a ground bus in each panel.

2. Boxes – Panelboards

    a. Provide at least minimum gutter space in accordance with NEC.

    b. Provide a minimum of four interior mounting studs.

    c. Provide door within a door front cover.

    d. Enclosures shall be as scheduled on the drawings, NEMA 12 minimum

3. Trim

    a. Provide barriers as required for completely dead-front construction.

    b. Provide minimum projection, chrome-plated latch with key lock on panelboards. Key all locks alike.

    c. Provide heavy plastic cover over permanent directory.

4. Bus Bars - All main bus bars shall be tin-plated copper sized in accordance with UL Standards to limit the temperature rise on any current carrying part to a maximum of 50 degrees C above air ambient of 40 degrees C maximum.

B. Lighting Panelboards (LP)

1. Definition - Lighting panelboards shall operate at 208Y/120 volt, 3 phase power. The panel may contain circuit breakers to power lighting and receptacles. The panel may contain breakers to power equipment other than lighting and receptacles.

2. Panelboard breakers shall be molded case, thermal magnetic trip, bolt-on connection, quick-make, quick-break, toggle handle circuit breakers. Two- and three-pole units shall be internal common trip type. Contacts shall be silver alloy.

3. Main circuit breakers shall be rated 22,000 A.I.C. or as indicated on the Drawings.

4. Panelboards for use at 240 volts AC maximum shall incorporate branch circuit breakers as shown or scheduled rated at 22k A.I.C. symmetrical at 240 volts.

5. Provide three handle padlock attachments for each, 1-pole, 2-pole, and 3-pole breakers.

6. Design Basis – Square D NQOD series.

C. Equipment Panelboard (PP)

1. Definition – Equipment panelboards are to operate on 480Y/277 volt, 3 phase power. Equipment panelboards shall not have a main circuit breaker larger than 225 amps. Equipment panelboards shall not have branch circuit breakers larger than 70 amps. The panel may contain circuit breakers to power lighting.

2. Panelboard Breakers - Molded case, thermal magnetic trip, bolt-on connection, quick-make, quick-break, toggle handle circuit breakers. Two- and three-pole units to be internal common trip type with silver alloy contacts.

3. Main Circuit Breakers - Rated at 22,000 A.I.C. or as indicated on the Drawings.

4. Panelboards for use at 480 or 600 volts AC maximum to incorporate branch circuit breakers as shown or scheduled rated at 25,000 A.I.C. symmetrical at 480 volts.

5. Design Basis - Square D Model NF series.

2.06 DISCONNECT AND SAFETY SWITCHES

A. Definitions

1. Disconnect Switches – Fusible and Non-fusible switches.

B. Characteristics

1. Heavy-duty type construction.

2. Number of poles shall be equal to the number of current carrying conductors.

3. Lockable in “off” or “open” and in the “on” or “closed” position.

4. Quick-make, quick-break switch mechanism.

5. Dual cover interlock to prevent opening of the switch door when handle is in the “on” position, and to prevent closing of switch mechanism with the door open. Provide a defeat mechanism.

6. Visible blade construction.

7. Single throw unless noted otherwise.

8. All main service safety switches shall come with an AR-type fuse rejection kit.

9. Manual transfer switch shall be triple pole, double throw, center position off, lockable.

C. Ratings

1. 600 volts for 480V systems and 240 volts for 208V systems. Ampere or horsepower rating as shown or required.

2. RMS symmetrical interrupting rating shall be 100,000 amperes for main service, 10,000 amperes otherwise.

3. Lugs shall be rated and U.L. listed for 60 degrees C and 75 degrees C wires.

D. Enclosures

1. U.L. listed.

2. NEMA 4X stainless steel for exterior and wet locations; NEMA 4X non-metallic for corrosive areas; NEMA 7 for hazardous locations; all others NEMA 12.

3. Provide with enclosure-mounted handle operator, operating through approximately 180-degree arc.

E. Fuses - Dual element RK1 current limiting type, time delay. RK5 for motor applications. Bussman Low-Peak LPN(S)-RK or approved equal.

F. Manufacturers - Heavy-duty Square D Class 3110; ABB Type TH; Eaton Type H-600; or approved equal.

2.07 NAMEPLATES AND LABELS

A. Nameplates

1. Material - Rigid laminated plastic.

2. Lettering Height - 5/16-inch high.

3. Lettering Color - White.

4. Background Color - Black.

B. Labels

1. Self-debossing, aluminum foil type.

2. Typewritten or preprinted black legends on white background.

3. Permanent Pressure-Sensitive Adhesive - Provide high temperature adhesive for labels on heat producing devices.

4. Use preprinted sleeve type for conductors. Label at each termination or splice.

5. Manufacturers - Seton or approved equal.

C. Equipment and Control Identification

1. In addition to the requirements of the NEC, install an identification label which will clearly indicate information required for use and maintenance of items such as panelboards, cabinets, motor controllers (starters), motor control centers, VFDs, safety switches, separately enclosed circuit breakers, individual breakers and controllers in switchgear and motor control assemblies, control devices and other significant equipment.

2. Provide nameplates for all electrical equipment and controls.

3. Attach nameplates with stainless steel or other non-corrosive metallic rivets or screws.

4. Provide a nameplate at each remote switch or control device when the controlled function is not readily identifiable.

5. All wiring except major power conductors shall have each end of the conductor labeled. Label wires at each junction box

D. Conduit Tags

1. 1.5” diameter stainless steel tags with etched or embossed lettering. Provide stainless steel wire ties.

2. Manufacturers – Brady or approved equal.

PART 3 – EXECUTION

3.01 CONDUIT INSTALLATION

A. Conduit System Fabrication

1. All interior conduit shall be installed exposed. No conduit shall be in or under slabs except for building incoming/outgoing systems.

2. No conduits within walls where the walls are below grade, i.e., in basements or galleries.

3. No conduit shall be run on the exterior face of any structure unless specifically shown exposed or approved by the Engineer prior to installation.

4. Conduit Defects - All conduit runs, cuts in coatings, to be free of indentations, elliptical sections, blisters, and other defects. Repair or replace damaged conduit sections as instructed by the Engineer.

5. Conduit Cutting - Cut all conduit ends square and remove all burrs. Cut conduit ends exactly to avoid excessive penetration into boxes.

6. Expansion Joints - Provide approved conduit expansion joints wherever conduit crosses a structural expansion joint; is attached between two separate structures; the conduit run is 50 feet or more in a single length for and conduit or 100 feet or more or wherever shown or specified. Support conduit on each side of the expansion joint.

7. Preparation for Conductor Installation - Prior to pulling cables in any conduit system, thoroughly clean the inside of each length of conduit by swabbing or the use of compressed air to remove all foreign matter. Then temporarily plug the ends of each conduit to prevent the entrance of dirt or foreign matter.

8. Couplings

    a. Tightly butt ends of conduit into the couplings.

    b. In exposed work only, where standard couplings cannot be used, only union-type couplings are permitted or as otherwise acceptable to the Owner.

9. Cutting of Structures – Keep the cutting of walls or floors for conduit to a minimum. Where such cutting is absolutely necessary, take care so as not to weaken the walls or floor involved. Do not cut beams or other structural supports under any condition.

10. Connection to Devices - Conduit attachment to all electrical equipment, such as sheet steel junction boxes, pullboxes, switches, etc., to be made with approved fittings with non-metallic bushings.

11. Conduit Bends and Elbows

    a. Rigid Metallic Conduit Systems

        1) Heating metal conduit to facilitate bending is strictly prohibited.

2) Field bending metal conduit is permitted as follows:

a) Type E - Up to and including 3/4-inch size.

3) For all rigid metal conduit larger than that above, use manufactured elbows or use hydraulic one-shot bender to fabricate bends.

4) Use manufactured elbows for all bends.

5) Make all bends with radius no less than NEC requirement.

6) Apply PVC spray for all exposed threads, cuts, etc.

12. Routing of Conduits - Keep the number of bends, offsets, and crossovers to a minimum; however, not more than three 90-degree elbows or equivalent bends up to 270 degrees is to be installed in any run between pulling or access fittings.

13. Structural - Make holes around conduit or cables watertight or gastight via silicone or acrylic latex masonry sealant upon completion of conduit or cable system

B. Conduit Size - Minimum conduit sizes shall be as follows unless specifically shown otherwise:

1. 3/4-inch for exposed locations (includes those areas above drop ceiling of lay-in tiles)

2. 1-inch for any concealed conduit in walls or within or beneath slabs.

C. Changes in Conduit Sizes - Made at pull or junction boxes except where specifically shown via a pull fitting.

D. Conduit and Sleeve Sealing

1. Seal inside of conduit (after installing and testing conductors) where passing through exterior walls or walls containing vapor seals or required to be gastight. Sealing may be accomplished by locating junction or approved sealing fitting at wall and filling with an approved waterproof electrical putty or sealing compound. Seal around all interior conduit passing through floor and wall boxouts.

2. Where driptight and watertight NEMA 4X and 12 installations are required, use only watertight hubs for top or side entry. Locknuts with gaskets are not acceptable. Conduits entering the top of electrical equipment are to either be sealed or located in such a manner as to prevent water from entering the equipment through the conduit system. Install conduit for ease of sealing.

3. Provide boxouts where conduit passes through poured-in-place concrete floors or walls. Core drill all other concrete walls, new or existing. Make cores 1-inch minimum, larger than O.D. of conduit.

E. Interior Walls

1. Non-Fire Rated Walls

a. Between Unclassified Areas

1) No Drop Ceiling or Below Drop Ceiling - Use core drilled holes.

2) Above Drop Ceiling

a) Air Handling Space - Core drill holes and seal around conduit.

b) Not Air Handling Space - Box out wall for conduits.

b. Between Classified or Classified/Unclassified Areas

1) Within 3/4-inch of wall face. Seal gastight and watertight with silicone acrylic latex masonry sealant. Fill hollow masonry voids with grout.

2) In concrete wall, seal around conduit with modular neoprene links and stainless steel compression bolts.

F. Access Fittings

1. May be used as required to facilitate installation of conductors or where shown.

2. Provide access fittings or conductors, as manufacturer recommends so as not to damage conductor or insulation during conductor pulling operations.

G. Pull and Junction Boxes - All pull and junction boxes shall be installed where shown or specified. Additional boxes may be installed as required to facilitate installation of conduit system.

3.02 CONDUCTOR INSTALLATION

A. Installation

1. Install products in accordance with manufacturers' instructions.

2. Do not pull thermoplastic wire at temperatures below 35 degrees F.

3. Protect exposed cable from damage.

4. Provide Kellem support grips when electrical cables hang in a vertical, sloping, or horizontal position.

5. Neatly train and lace wiring inside boxes, equipment, and panelboards.

6. Install electrical circuit loadings as designed on Contract Drawings unless approved otherwise by Engineer.

7. Where instrumentation cables are installed in panels, etc., the Contractor shall arrange wiring to provide maximum clearance between instrumentation cables and other conductors. Instrumentation cables shall not be installed in the same bundle with conductors of other circuits.

8. Intrinsically safe conductors shall be in separate conduits both inside and outside enclosure and shall be terminated on terminal strips with barriers. Barriers are to physically isolate intrinsically safe conductors from non-intrinsically safe conductors.

9. Wiring Diagrams

    a. Any wiring diagrams shown on plans for hookup of equipment furnished by others are approximate and are for bidding purposes only.

    b. Obtain wiring diagrams, certified correct for the job, from respective supplier for all equipment and systems furnished by them.

    c. Install all work in accordance with certified wiring diagrams.

10. Electrical Trade to provide all power, control, and signal wiring and conduits between system components (including installation of any conductors supplied by other trades), including final connections to labeled terminal strips integral in equipment, as shown on Drawings, and in accordance with approved manufacturer's wiring diagrams. Exception is for certain HVAC conduit and wiring where specifically shown or specified to be by HVAC Trade.

B. Color Coding

1. Provide color coding for all service, feeder, branch, control, fire alarm, and signaling circuit conductors.

2. Grounded Conductor Color Coding in New Installations

    a. Ground – Green.

    b. Neutrals – White for 120V systems; gray for 277V systems.*

1) *Exception - Where neutrals of more than one system are installed in the same raceway or box, each neutral shall be white or gray with a different colored (not green) stripe.

3. In addition to existing facilities, ungrounded conductors in different voltage systems shall match the existing system and/or be as follows:

a. 120/208-volt, 3 phase: Phase A - Black

b. 120/240* Phase B – Red, Phase C – Blue

1) *For high (“wild” or red) leg delta system, the high leg shall be orange.

c. 277/480-volt, 3 phase: Phase A – Brown, Phase B – Orange, Phase C - Yellow

d. 120/208 or 120/240-volt, single phase: Red and black.

e. DC Power- Positive Lead - Red.

1) - Negative Lead - Black.

f. DC Control - All blue.

g. 120-volt Control Wiring - Single conductor AC control wire shall be red, except a wire entering a motor control center compartment or control panel which is an interlock shall be color coded yellow.

h. 24-volt Control Wiring - Orange.

i. Neutral (Grounded Conductor) - White or gray.

j. Grounding Conductor - Green.

C. Conductor Sizing

1. Conductor sizes that are shown for equipment branch circuits are the minimum sizes allowed. Refer to schedule in Paragraph 3.02.C.2.c. below for sizing conductors on circuits longer than the minimum length shown for the various voltages. Adjust conduit sizes accordingly.

2. Wiring shown without size to be sized by one of the following methods, whichever is larger. No additional payment will be made for oversized conduit or conductor.

a. Power and Lighting Circuits - Minimum size No. 12 AWG. Quantity as required for proper operation. Use 3/4-inch conduit types as required for the area where conduit is installed.

b. Control Circuits - Minimum size No. 14 AWG. Quantity as required for proper operation, use 3/4-inch conduit, type as required for the area where conduit is installed.

c. Increase minimum size conductors for 20 ampere single phase circuits where distance between power source and item served exceeds noted length in accordance with the following table. No more than 2 percent voltage drop of all branch circuits at equipment's rated full load current is permitted.

120 volts	100' to 150'	#10	151' to 225'	#8	226' up	#6
208/240 volts	100' to 175'	#10	175' to 250'	#8	251' up	#6
265/277 volts	125' to 200'	#10	201' to 300'	#8	301' up	#6
460/480 volts	225' to 350'	#10	351' to 525'	#8	526' up	#6

d. Minimum size of branch circuits over 20 amps per requirements of NEC Tables 310.16 thru 310.31.

3. Neutral Wire - To be equal to ungrounded wires unless otherwise shown.

4. Ground Wire - Minimum size as required by the NEC Table 250-122.

D. Spare Conductors - Wherever groups of control and instrumentation conductors are required, provide the following minimum numbers of spare conductors. As required, Contractor shall increase conduit sizes shown to accommodate spare conductors. Terminate at terminal strips on both ends and mark as spare and indicate the location of opposite end.

Conductors	Spares
Up to 10	4
11 to 18	6
19 and over	8

3.03 CONDUCTOR STRANDING

A. All conductors shall be stranded except for interior lighting and receptacle circuits #10 and smaller.

3.04 CONNECTORS AND TERMINATIONS

A. Use manufacturer's standard lugs for connection of conductors to equipment panel or devices.

B. Use UL approved wire nuts for lighting and receptacle circuits and for other circuits, compression connectors for connection of conductors to other conductors.

C. Terminal Board Terminations - All interconnecting instrumentation wiring to terminal boards and strips to be made with insulated crimp type connectors (locking fork type). Stranded wire is not to be directly connected to terminals without the use of connectors unless the terminations are specifically made to accept bare stranded wire, i.e., tubular clamp type termination. No loose strands shall be permitted outside of the connector, whichever is utilized.

D. Motor Connections

1. Motors Less Than 1 HP - Use wire nut appropriate for the environment where the motor is located.

2. Motors From 1 to 20 HP - Use branch circuit crimp-type connectors.

3. Motors Above 20 HP - Use bolted wire connectors. Insulate the connector with insulating putty to at least 7/64 inch and tape the insulated connection with two layers half lapped of neoprene splicing tape.

E. Splicing - Make splices in accessible locations and in junction boxes. No splices will be permitted in pulling fittings or MCC wiring spaces.

3.05 GROUNDING

A. Maintain electrical integrity of conduit system throughout. Provide bonding jumpers at fittings as required; jumpers to be no longer than required. Provide separate ground wire for all conduit systems and where grounding integrity is doubtful.

B. Basic intent of grounding specification is that grounding conductor be completely separate from system neutral and that neutral only be connected to ground at the main service grounding point. Run equipment ground independently back to main service ground. Use separate insulated (green) grounding conductors for all grounding conductors. Where ground passes through panels and disconnects, braze ground lugs to panel or disconnect housings. Isolate neutral bus or lug from ground. Ground all conduits at each panel.

C. Shielding to be continuous and grounded at one point only unless otherwise required by equipment manufacturer’s recommendations.

3.06 EQUIPMENT AND DEVICE MOUNTING HEIGHTS

A. Mounting heights are as follows, unless otherwise noted:

1. Receptacles - 48 inches.

2. Switches - 45 inches to the center.

3. Thermostats - 54 inches.

4. Enclosed Starters or Circuit Breakers

    a. Wall Mounted - 66 inches to top.

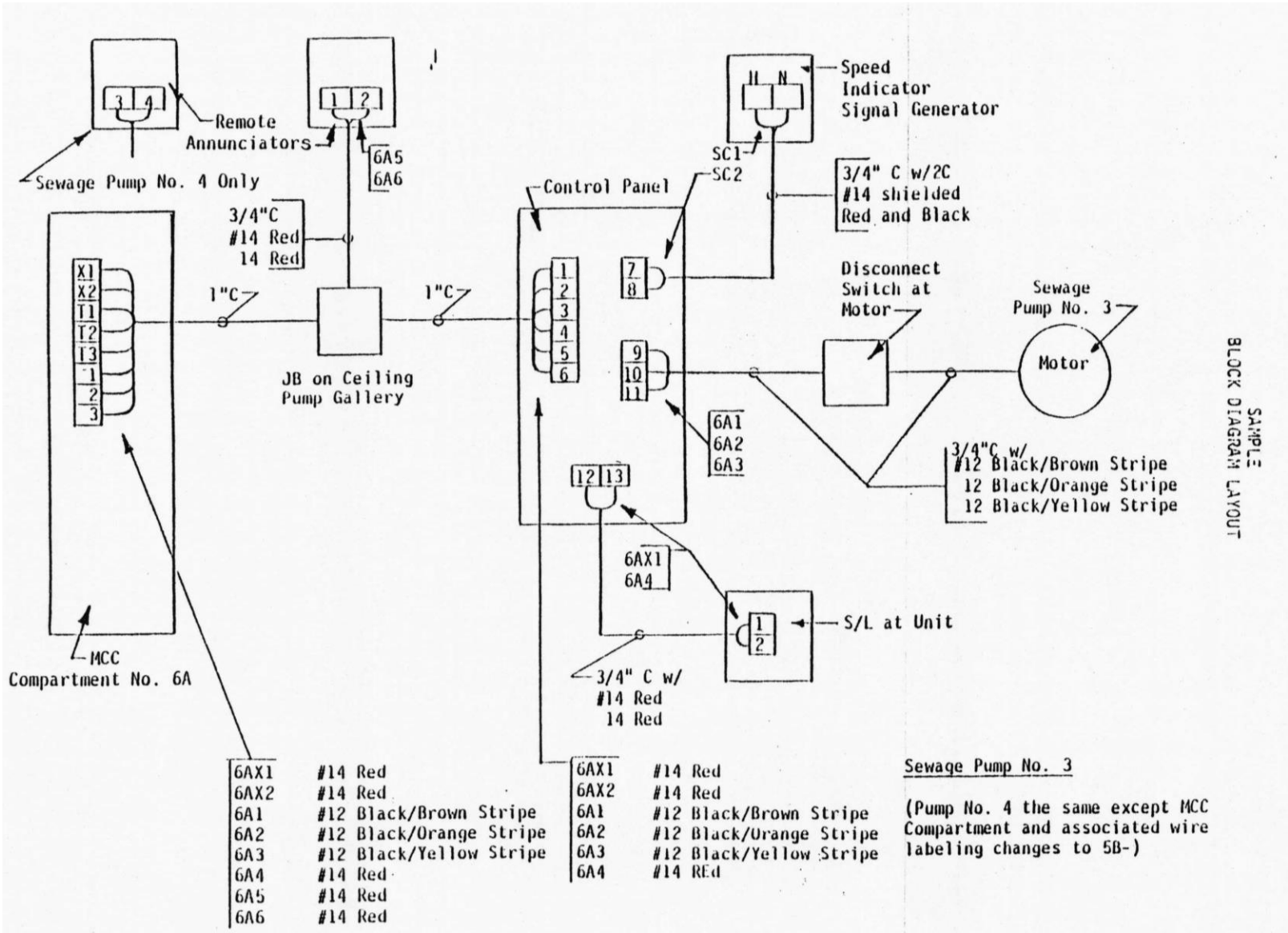
    b. Interior Mounting Stand/Exterior Not on Tank – 36 inches to center of operating handle for equipment less than 60 inches high.

    c. Exterior Mounting on Tanks – 36 inches to center.

5. Control or Starter Panels - See Section 26 27 16 – Control Panels and Enclosures

6. Panelboards - 66 inches to top.

7. Disconnect Switches - See Section 26 27 16 – Control Panels and Enclosures


Remote Annunciators
Sewage Pump No. 4 Only
6A5
6A6
3/4"C
#14 Red
14 Red
1"C
1"C
JB on Ceiling
Pump Gallery
Control Panel
SC1
SC2
Speed Indicator Signal Generator
3/4" C w/2C
#14 shielded
Red and Black
Disconnect Switch at Motor
Sewage Pump No. 3
Motor
6A1
6A2
6A3
3/4"C w/
#12 Black/Brown Stripe
12 Black/Orange Stripe
12 Black/Yellow Stripe
6AX1
6A4
S/L at Unit
3/4" C w/
#14 Red
14 Red
MCC
Compartment No. 6A
6AX1 #14 Red
6AX2 #14 Red
6A1 #12 Black/Brown Stripe
6A2 #12 Black/Orange Stripe
6A3 #12 Black/Yellow Stripe
6A4 #14 Red
6A5 #14 Red
6A6 #14 Red
6AX1 #14 Red
6AX2 #14 Red
6A1 #12 Black/Brown Stripe
6A2 #12 Black/Orange Stripe
6A3 #12 Black/Yellow Stripe
6A4 #14 REd
Sewage Pump No. 3
(Pump No. 4 the same except MCC Compartment and associated wire labeling changes to 5B-)
SAMPLE BLOCK DIAGRAM LAYOUT

END OF SECTION

SECTION 26 00 15

SHORT-CIRCUIT, COORDINATION, AND ARC-FLASH ANALYSIS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Section includes a preliminary and a final computer-based, short-circuit, coordination and arc-flash studies to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

2. Study shall be performed to include new power distribution equipment and existing power distribution equipment designated to remain. Study shall include all electrical distribution and control equipment, new and existing to remain, included in the contract documents.

3. The project shall begin at the point of service for the Main Pump Station, through the Motor Control Center and continue down through the system, to all downstream 480 volt and 208 volt distribution and branch circuit panelboards, motor control centers, variable frequency drives and significant motor locations/local disconnects.

4. The final study shall be provided after the installation of the power distribution system is complete.

5. The short circuit current available will be provided by the Owner in the existing Arc Flash Study.

B. Related Documents

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

1.02 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.03 SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following submittals after the approval of system protective devices submittals.

1. Study input data, including completed computer program input data sheets.

2. The short-circuit, protective device coordination and arc-flash studies shall be submitted to the Engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the Engineer may be obtained for preliminary submittal of sufficient study data to ensure that the selection of device and characteristics will be satisfactory. Generally, shop drawing submittals for equipment effected by the coordination study will not be reviewed until the short-circuit/coordination study has been submitted and successfully reviewed.

3. The results of the short-circuit, protective device coordination, and arc-flash hazard analysis studies shall be summarized in a final report. Submit bound copies of the final report with tabbed sections, in the quantities required. Additional copies, where required, shall be provided on CD in PDF format.

4. Arc-flash study report; signed, dated, and sealed by a qualified Professional Engineer registered in the state of New York.

a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

b. The report shall include, but not be limited to, the following sections:

1) One-line diagram showing protective device ampere ratings and associated designations, cable size & lengths, transformer kVA and

voltage ratings, motor and generator kVA ratings, switchboard and panelboard designations.

2) Descriptions, purpose, basis and scope of the study.

3) Tabulations of the worst-case calculated short circuit duties as a percentage of the applied device rating (automatic transfer switches, circuit breakers, fuses, etc.); the short circuit duties shall be upward adjusted for X/R ratios that are above the device design ratings.

4) Protective device time versus current coordination curves with associated one line diagram identifying the plotted devices, tabulations of ANSI protective relay functions and adjustable circuit breaker trip unit settings.

5) Fault study input data, case descriptions, and current calculations including a definition of terms and guide for interpretation of the computer printout.

6) Details of the incident energy and flash protection boundary calculations.

7) Sample of an arc-flash hazard warning label.

8) Comments and recommendations for system improvements, where needed, including extending of feeder or other conductors necessary to lower the fault-current to an acceptable level.

9) Executive Summary.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance procedures according to requirements in NFPA 70E shall be provided in the equipment manuals.

B. Operation and Maintenance Procedures: provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.

1.05 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with the requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Arc-Flash Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Arc-Flash Study Specialist Qualifications: Professional Engineer in charge of performing the study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the National Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to Authorities Having Jurisdiction.

PART 2 – PRODUCTS

2.01 COMPUTER SOFTWARE DEVELOPERS

A. Software Developers: Subject to compliance with requirements, available software developers offering software that may be used for the Work include, but are not limited to, the following:

1. ESA Inc.;

2. SKM Systems Analysis, Inc.;

3. Or approved equal.

B. Comply with IEEE 1584 and NFPA 70E.

1. See Evaluations for more information on IEEE 399.

C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

2.02 DATA COLLECTION

A. Contractor shall furnish all field data as required by the power system studies and arc-flash hazard analysis. The Study Preparer shall furnish the Contractor with a listing of required data. The Contractor shall expedite collection of the data to eliminate unnecessary delays and assure completion of the studies as required for final approval of the distribution equipment.

B. Source contribution may include present and future utility supply, motors, and generators.

C. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner or Contractor.

D. Include fault contribution of existing motors in the study, with motors < 25 hp grouped together. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

2.03 SHORT-CIRCUIT ANALYSIS WITH PROTECTIVE DEVICE EVALUATION

A. Systematically calculate fault currents based on the available fault current at the facility service entrance. Study preparer shall obtain the available fault current from the local utility.

B. Short-circuit calculations shall be prepared by means of a digital computer utilizing a commercially available software package. Motor contribution shall be incorporated in determining fault levels. Results of short-circuit calculations shall be presented in tabular form and shall include momentary and interrupting fault values for three-phase and phase-to-ground faults.

C. Analyze the short-circuit currents by preparing a tabulation comparing the fault levels to the device interrupting ratings. Indicate areas in which integrated/series ratings are utilized. The following information shall be included in the tabulation:

1. Bus identification number.

2. Location identification.

3. Voltage.

4. Manufacturer and type of equipment.

5. Device rating.

6. Calculated short-circuit current.

2.04 PROTECTIVE DEVICE COORDINATION STUDY

A. Prepare coordination time-current characteristic curves to determine the required settings/sizes of the protective devices to maximize selectivity. The utility upstream protective device feeding the facility shall be maintained as the upper limit for coordination. These settings shall be obtained by the preparer, along with any other protective device setting requirements. The coordination curves shall be prepared on log-log paper and illustrate adequate clearing times between series devices. The curves shall be created through the use of the study software package, but must reflect actual

protective devices to be installed. Adequate time-current curves shall be generated to depict coordination. In addition, protective device characteristics shall be suitably determined to reflect calculated short-circuit levels at the location.

B. A narrative analysis shall accompany each coordination curve sheet and describe the coordination and protection in explicit detail. All curve sheets shall be multi-color for improved clarity. Areas lacking complete coordination shall be highlighted and reasons provided for allowing condition to remain or provide solution to resolve situation. The following information shall be provided on all curve sheets:

1. Device identification and associated settings/size.

2. Voltage at which curves are plotted.

3. Current multiplier.

4. ANSI frequent fault damage curve.

5. Cable insulation damage curves.

6. Transformer inrush point.

7. Single-line for the portion of the system.

8. Motor starting profiles (where applicable).

2.05 ARC-FLASH HAZARD ANALYSIS

A. The Arc-Flash Hazard Analysis shall be performed by a computer aided circuit simulation of the distribution system specific to this project. These calculations shall determine the Arc-Flash Incident Energy (AFIE) levels and flash protection boundary distances. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, panelboards, busway, generators, automatic transfer switches, and motor-control centers) where work could be performed on energized parts.

B. The Arc-Flash Hazard Analysis shall be performed in conjunction with the Short-Circuit/Coordination Study.

C. Results of the analysis shall be submitted in tabular form and shall include as a minimum the bus name, bolted fault current and arcing fault current level, flash protection boundary distances, personal protective equipment (PPE) hazard risk category and the AFIE levels.

D. The analysis shall be performed under worst-case Arc-Flash conditions, and the final report shall describe the worst-case conditions when different from worst-case bolted fault conditions.

2.06 ARC-FLASH WARNING LABELS

A. Produce a 3.5-by-5-inch thermal transfer label of high-adhesion polyester for each work location included in the analysis.

B. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

1. Location designation.

2. Nominal voltage.

3. Flash protection boundary.

4. Hazard risk category.

5. Incident energy.

6. Working distance.

7. Engineering report number, revision number, and issue date.

C. Labels shall be machine printed, with no field-applied markings.

2.07 SINGLE-LINE DIAGRAM

A. The final report shall include a multi-color single-line diagram of the electrical distribution system within the scope of the project. The single-line shall include:

1. Transformer rating, voltage ratio, impedance, and winding connection.

2. Feeder cable phase, neutral and ground sizes, length of cable, conductor material, and conduit size and type.

3. Switchgear, switchboards, panelboards, MCC’s, fuses, circuit breakers, ATS’s and switches continuous current ratings.

4. Protective relays with appropriate device numbers and CT’s and PT’s with associated ratios.

5. Detailed legend indicating device type identification and other significant details.

PART 3 – EXECUTION

3.01 SUMMARY The results of the system studies shall be summarized in a final report. One "as-built" copy shall be posted in each main electric or MCC room.

3.02 FIELD SETTINGS/ADJUSTMENTS

A. This Contractor shall engage the equipment manufacturer's service group or alternately a qualified independent testing firm to perform field adjustments of the protective devices as required for placing the equipment in final operating condition. The settings shall be in accordance with the approved short-circuit study and protective device evaluation/coordination study.

B. Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with the approved short-circuit and protective device coordination study, shall be carried out by the equipment manufacturer's service group or qualified independent testing firm.

C. Notify Engineer in writing of any required major equipment modifications.

D. Additions, deletions, upgrades or major modifications to any part of the electrical distribution system will require re-calculation of the studies and analysis' for the portions of the system that has been changed from the original studies. These re-calculations shall be completed by the same engineer or firm that did the original studies, at no additional cost to the Owner.

3.03 ARC-FLASH WARNING LABELS

A. Apply arc-flash warning labels to equipment. The labels shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

3.04 ARC-FLASH TRAINING

A. The Contractor of the Arc-Flash Hazard Analysis shall train the Owner's qualified electrical personnel of the potential arc-flash hazards associated with working on energized equipment (minimum of 4 hours). The training shall be certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET) or equivalent.

END OF SECTION

SECTION 26 04 86

MOTOR CONTROL CENTERS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Section Includes:

1. Contractor shall provide all labor, materials, equipment, services, and incidentals as shown, specified, and required to furnish and install motor control centers, complete and operational.

2. Motor control centers (MCC) required under this Section are low-voltage, free-standing, metal enclosed equipment. Motor control centers shall be customized.

3. Retrofit of existing Main Pump Station MCC-B, compartments as shown on the Contract Drawings.

B. Related Sections:

1. Section 01 77 19 – Closeout Requirements

2. Section 26 00 10 – Electrical Work

1.02 REFERENCES

A.	NFPA 70	National Electrical Code
B.	UL 198C	High-Interrupting Capacity Fuses; Current Limiting Type
C.	UL 198E	Class R Fuses
D.	UL 845	Motor Control Centers
E.	NEMA AB 1	Molded Case Circuit Breakers
F.	NEMA ICS 2	Industrial Control Devices, Controllers, and Assemblies
G.	NEMA ICS 2.3	Instructions for the Handling, Installation, Operation, and Maintenance of Motor Control Centers
H.	NEMA ICS 2	Industrial Control Devices Controllers and Assemblies
I.	ANSI Z55.1	Gray Finishes for Industrial Apparatus and Equipment
J.	NEMA ICS 18	Motor Control Centers

1.03 SUBMITTALS

A. Shop Drawings – phase, neutral, and ground; electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time/current curves of all equipment and components; factory elementaries for each compartment.

B. Samples shall be submitted as may be requested by the Engineer.

C. Test Reports - Indicate field test and inspection procedures and test results.

D. The Contractor shall furnish a reproducible copy and four prints of the approved as-built wiring diagrams showing all wiring in the distribution and control center.

E. Manufacturer's Installation Instructions - Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

F. Action Submittals: Submit the following:

1. Shop Drawings

    a. Dimensional information and construction details of enclosures. Enclosure details shall consist of exterior and interior front door with nameplate legends, interior door front and rear views, and terminal block layout.

    b. Contractor shall verify that field measurements are as indicated on shop drawings. Depth and Width shall match existing motor control centers to be replaced. Contractor shall verify existing dimensions in field.

    c. Three-line power and control schematic diagrams.

    d. Wiring diagrams showing the interconnection of conductors to all devices with terminal assignments for remote devices.

    e. Functional description of system operation.

    f. VFD/starter/circuit breaker heat dissipation at full load, including heat rejection/cooling system.

2. Product Data

    a. Manufacturer's technical specifications.

    b. Manufacturer's catalog cuts and product literature.

3. Testing Plans

a. Not less than thirty days prior to source quality control testing, submit descriptions of proposed shop testing methods, procedures, apparatus, and limitations.

b. Not less than thirty days prior to field quality control testing, submit descriptions of proposed field testing methods, procedures, and apparatus.

G. Seismic considerations: the Building Code of the State of New York, latest edition (including amendments) shall be in effect. Submit shop drawings for all electrical supports and anchors that include seismic restraint calculations and details as required to meet earthquake design data indicated on the structural drawings. Calculations and details, if required, shall be designed and stamped by a New York registered professional engineer retained by the Contractor.

H. Informational Submittals: Submit the following:

1. Source Quality Control Submittals

a. Within five days of completing source quality control tests and inspections, submit test results with indication of whether all criteria of the Contract Documents for the specified equipment were met.

2. Field Quality Control Submittals

a. Within five days of completing field quality control tests and inspections, submit test results with indication of whether all criteria of the Contract Documents for the specified equipment were met.

3. Manufacturer Reports

a. Within five days of each visit to the site by manufacturer’s representative, submit written report of reason for visit, problems encountered, solutions implemented, and remaining work.

4. Qualifications Statements

a. Manufacturer, when requested by the Engineer.

I. Closeout Submittals: Submit the following:

1. Operation and Maintenance Data

a. Submit complete installation, operation and maintenance manuals including test reports, maintenance data and schedules, description of operation, list of recommended spare parts, and spare parts ordering information.

b. Manuals shall include record drawings of control schematics, including point-to-point wiring diagrams.

c. Include a listing of all programmable drive parameters and their settings at Substantial Completion. Submit parameters as both printed pages in the operations and maintenance manual and in electronic format on compact disc that can be directly uploaded to the drive in event of drive replacement or repair.

d. Comply with Section 01 77 19 – Closeout Requirements.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with NEMA ICS 2.3.

B. Maintain one copy of each document on site.

1.05 QUALIFICATIONS

A. Manufacturer - Company specializing in manufacturing the products specified in this Section with a minimum of three years' documented experience.

1.06 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70, Underwriters Laboratories Publication UL-845, and NEMA Publication ICS-2.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. testing firm acceptable to authority having jurisdiction as suitable for purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver in individual sections splits, individually wrapped for protection, and mounted on shipping skids such that the equipment may be delivered through existing building openings and doors.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle in accordance with NEMA ICS 2.3. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to motor control center components, enclosure, and finish.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Conform to NEMA ICS 2 service conditions during and after installation of motor control centers compartments.

1.09 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings. Depth and Width shall match existing motor control centers to be replaced. Contractor shall verify existing dimensions in field.

1.10 EXTRA MATERIALS

A. Provide the following materials, each tagged or conspicuously marked or labeled with the manufacturer's name, part number and name. All parts shall appear on a typed list showing the above plus quantity and location.

1. One box (minimum 10) of each size control power fuses furnished.
2. One set of starter contacts for every two starters or fraction thereof of each NEMA size installed.
3. One starter coil for every five NEMA size starters installed (all starters are full sized NEMA).
4. One control potential transformer for each size installed.
5. Four (4) control relays, timing relays and motor timing relays of each type used.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Square D, Model 6 series (Design Basis);

B. ABB, 9000 series;

C. Eaton, Freedom 2100 series;

D. Or approved equal.

2.02 GENERAL

A. Provide motor control center compartments as shown on the Drawings.

B. Motor Control Center Compartments - NEMA ICS 2, Class I, Type B-D wiring with terminal blocks mounted on lift out brackets in the vertical wire trough units for combination starters size 0-4.

C. Terminals - Accept all control and power wiring through Size 2.

D. Voltage Rating – 480 volts, three phase, three wire, 60 Hertz as indicated on the drawings.

E. Integrated Equipment Short Circuit Rating - 65,000 amperes RMS symmetrical at 480 volts.

F. Configuration – Units front mounting only, accessible from the front only.

G. Bus – tin plated copper, furnish neutral and ground buses for entire length of MCC.

H. Enclosure – NEMA ICS 6, Type 12 with gasketed doors.

I. Dimensions

1. Depth and Width shall match existing motor control centers to be replaced. Contractor shall verify existing dimensions in field.

2. Vertical Sections - 6-1/2 space factors of unit mounting space or match existing.

3. Height - 91 inches.

J. Material

1. Exterior Frame - Fabricated from copper bearing reinforced steel plate construction.

K. Bus Barriers

1. Permit unit plug-on contacts to pass through and engage the vertical bus bars.

2. Unused Plug-On Openings - Provide plastic closing plates.

L. Plug-On Connections

1. Two-point connection to tighten around the vertical bus bar.

2. Material - Silver plated.

3. Cable Connections to the Plug-On Connections - Bolted type.

M. Bucket Alignment - Guide rails within the structure for horizontal and vertical alignment.

N. Horizontal wireways shall be provided at the top and bottom of each motor control center. Vertical wireways shall be provided when more than one compartment is provided in a single vertical section.

O. Horizontal and vertical bus ratings shall be provided as shown on the drawings (minimum), or as recommended by the manufacturer.

P. A copper ground bus shall be provided throughout the entirety of the motor control center's length. Size as recommended by the manufacturer.

2.03 AUTOMATIC CONTROLLERS

A. Magnetic Motor Controllers - NEMA ICS 2, AC general purpose Class A magnetic controller for induction motors rated in horsepower. Minimum NEMA Size 0.

B. Reversing Controllers - Include electrical interlock and integral time delay transition between Forward and Reverse rotation.

C. Two-Speed Controllers - Include integral time delay transition between FAST and SLOW speeds.

D. Coil Operating Voltage - 120, 60 Hertz.

E. Overload Relay - NEMA ICS; melting alloy

2.04 PRODUCT OPTIONS AND FEATURES TO BE PROVIDED

A. Auxiliary Contacts - NEMA ICS 2, 2 each normally open and closed contacts in addition to seal-in contact.

B. Cover Mounted Pilot Devices - NEMA ICS 2, heavy duty oiltight type. LED lamps, push-to-test type.

C. Pilot Device Contacts - NEMA ICS 2, Form Z, rated A150.

D. Surge Protective Device – Provide 160kA MOV type SPD with overcurrent protection as recommended by manufacturer. SPD shall include surge counter and LED status indicators

E. Power Monitoring

1. A digital power monitoring device shall be provided as located on the drawings, including all PTs, CTs, fuses, wiring, etc.

2. Ammeter and Volt Meters

a. percent of full scale.

b. Taut-band design type.

c. 4-1/2-inch rectangular type.

3. Measured parameters shall at a minimum include: kW, kVAR, kVA, True Power Factor, kWh, kVARh, kVAh, Voltage, Current, Frequency, Voltage Unbalance, Current Unbalance, kW Demand, kVAR Demand, kVA Demand, Max./Min. Logs, and Total Harmonic Distortion (THD).

4. Each motor control center main circuit breaker(s) shall have power monitoring with Modbus TCP/IP Ethernet communications capabilities. Each shall be:

a. Square D;

b. PowerLogic PM5000 series;

c. Or approved equal.

2.05 DISCONNECTS

A. Combination Controllers - Combine motor controllers with thermal magnetic circuit breakers disconnect in common enclosure. Provide means for locking disconnect handle and means for defeating cover interlock.

B. Motor Circuit Protector - NEMA AB 1, circuit breakers with integral instantaneous magnetic trip in each pole.

C. Disconnect Operator - All circuit disconnecting means shall be handle operated through approximately an 180 degree arc to open or close the device. With labeled and color coded “On,” “Off,” and “Tripped” position indicators. Provide means of locking disconnect in the “Off” position. Provide auxiliary contacts for disconnect switches, contacts shall be Early Break and Late Make.

2.06 RETROFIT OF EXISTING MCCs TO REMAIN

A. Contractor shall provide complete retrofit cubicles for existing MCC equipment to be removed and replaced as shown on the Contract Drawings.

B. Retrofit cubicles shall be completely compatible without modifications to the existing MCC structure. Retrofit cubicles shall be new. Refurbished or remanufactured cubicles shall not be accepted. Retrofit cubicles shall comply with UL 845 standards.

C. Provide all equipment as required for a complete and operational system. Provide cubicle cassette, disconnects, circuit breakers, wiring, bus work, starters, relays, devices, etc. as shown on the Contract Drawings. All retrofit cubicles shall be provided with new sheet metal cubicle doors and nameplates.

D. Manufacturers

1. Eaton - MCC Aftermarket and Direct Replacements. Existing Main Pump Station MCC-B is Eaton Freedom 2100 series, rated 65kAIC.

2.07 SOURCE QUALITY CONTROL

A. Tests

1. Perform factory tests on each motor control center prior to shipping. Tests shall consist of simulating expected load to be driven (using a test motor supplied by the manufacturer) by operating load through speed ranges specified for driven equipment, for minimum of two hours per drive unit.

2. Provide factory control and alarm tests on each unit by simulating each control signal and each alarm function to verify proper and correct drive unit action.

3. Perform specified tests in addition to standard factory tests typically performed.

4. Submit type written factory test reports

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that surface is suitable for motor control center compartments installation.

B. The manufacturer of this equipment will be permitted to arrange his equipment to the best advantage and will be required to furnish at least the spare compartments as noted on the Drawings.

C. Examine conditions under which the Work will be installed and notify the Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Install motor control centers in accordance with manufacturer’s instructions.

B. Tighten accessible bus connections and mechanical fasteners after placing motor control center.

C. Install fuses in fusible switches.

D. Select and install heater elements in motor starters to match installed motor characteristics.

E. Provide nameplates under the provisions of Section 26 00 10 – Electrical Work.

F. Motor Data - Provide neatly typed label inside each motor starter door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

G. Wiring Diagrams - Elementary diagram shall be glued inside each compartment door housing a motor controller, relay, or similar equipment. Other compartments shall also have approved final unit wiring diagrams glued on the inside face of door as well as a heater selection table. Compartments containing panelboards shall have a circuit directory mounted inside the door. All diagrams shall reflect all field modifications.

H. Motor control centers shall be mounted on raised concrete bases unless noted otherwise. Connections to external equipment and connections of the incoming services shall be as shown or as required by the equipment manufacturer.

3.03 FIELD QUALITY CONTROL

A. Inspect each controller to NEMA ICS 2.

B. Site Tests

1. After installation, inspect, adjust, and test each low-voltage motor starter at the site. Testing and inspection shall be in accordance with manufacturer's recommendations and be performed by manufacturer's factory-trained representative. Through the Contractor, manufacturer's factory-trained representative shall inform the Owner and the Engineer when equipment is correctly installed and ready to be energized. Do not energize equipment without permission of the Owner and Engineer.

2. Perform the following equipment inspection and testing and provide reports documenting procedures and results.

    a. Verify all device settings and drive adjustments.

    b. Inspect all mechanical and electrical interlocks and controls for proper operation.

    c. Test each starter/drive through specified speed ranges and loads for a minimum of two hours per drive unit.

    d. Test each starter/drive by using actual control signal for remote and local operation.

    e. Test each starter/drive alarm function.

    f. Perform other tests recommended by equipment manufacturer.

C. Manufacturer Services

1. Unloading and Installation: Manufacturer's factory-trained representative shall be present during unloading of equipment and installation at equipment's final location. Representative shall train installing personnel in advance in the proper handling and rigging of equipment. Services by manufacturer's representative under this paragraph shall be at least (2) eight-hour days at the site.

2. Post-installation Check: Manufacturer's factory-trained representative shall check and approve the installed equipment before initial operation. Services by manufacturer's representative under this paragraph shall be at least (2) eight-hour days at the site

3. Manufacturer's factory-trained representative shall adjust the system to final settings as specified in Article 3.05 of this Section.

4. Manufacturer's factory-trained representative shall test the system as specified in Article 3.05 of this Section. Representative shall operate and test the system in presence of the Engineer and verify that equipment is in conformance with the Contract Documents. Services by manufacturer's representative under this paragraph shall be at least (3) eight-hour days at the site.

5. Representative shall revisit the site as often as necessary until all deficiencies are corrected, prior to readiness for final payment.

6. Provide services of manufacturer's factory-trained representatives to correct defective Work within 72 hours of notification by the Owner during the correction period specified in the General Contract Conditions as may be amended by the Supplemental Contract Conditions.

7. Replacement parts or equipment provided during the correction period shall be equal to or better than original.

8. Training: Provide services of qualified factory trained specialists from manufacturer to instruct Owner's operations and maintenance personnel in recommended operation and maintenance of equipment. Training shall be provided for a minimum of two (2), four (4) hour sessions and accommodate up to five of the Owner's personnel.

3.04 LABELING AND IDENTIFICATION

A. All interior relays, timers or other control devices shall be labeled according to its designation on the elementary diagram.

B. Each control center compartment (bucket) shall have its own identification nameplate fastened to the unit saddle. These nameplates shall have suitable references to factory records for efficient communication with supplier or manufacturer.

3.05 TESTING

A. Prior to connection of any external feeder or load circuits, MCC breakers shall be electrically tested.

B. Make all connections in accordance with the torquing specifications provided by the manufacturer.

C. All connections shall be given an infrared thermograph scan after the unit is operational and with each unit operating at as near full load as possible.

D. Contractor shall retorque or redo connections identified as potential problems.

E. Contractor shall individually adjust all trip units for the specific requirements of each device.

F. Contractor shall submit a letter of certification that all of the above have been done, are correct, and are fully operational in accordance with the control diagrams where applicable.

END OF SECTION

SECTION 26 05 26

GROUNDING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Items to be grounded include all new or modified work of this Contract, but not be limited to metallic water services, equipment housings, motor frames, metal raceways, bus duct enclosures, grounding terminals of outlets, outdoor lighting fixtures, footing rebar, ductbanks, manholes, pullboxes, and transformer secondary neutrals. In addition to the National Electrical Code (NEC) requirements and the above, the following, where a part of this project, shall be permanently and effectively grounded:

    a. All structural metals.

    b. All metallic panels and conduit.

    c. Motor frames.

    d. All metallic equipment bases.

    e. Metallic handrailing.

2. Take special precautions to ground all equipment in strict accordance with the NEC and as otherwise noted in these specifications.

B. Related Section:

1. Section 01 33 00 – Submittal Procedures

2. Section 26 00 10 – Electrical Work

1.02 REFERENCES

A. All materials and installations shall be in accordance with the latest revisions of the following:

1. National Electrical Code

2. Underwriters Laboratories, Inc.

1.03 SUBMITTALS

A. Provide submittals and samples in accordance with Sections 01 33 00 – Submittal Procedures and Section 26 00 10 – Electrical Work.

B. Submitted for all materials used in connection with the grounding system.

C. Submit a 12-inch sample of the ground system rope-lay conductor and other samples as may be requested by the Engineer.

D. Certified test reports of grounding system resistance.

PART 2 – MATERIALS

2.01 ELECTRODES

A. Ground Rods – 5/8-inch diameter x 10 feet long (minimum) steel core copper jacketed.

1. Rods shall be manufactured by:

a. Copperweld Steel Company;

b. Thompson Lightning Protection, Inc.;

c. Or approved equal.

B. System shall be UL listed.

C. System access from grade shall incorporate the use of a concrete or polyplastic box for protection with a steel cover. Box shall be installed flush with finish grade.

1. System Manufacturers:

a. Superior Grounding Systems;

b. XIT Grounding System;

c. Or approved equal.

2.02 CONDUCTOR

A. Ground Conductor (Above Grade) - Type XHHW insulated wire in conduit or other raceway. Color code insulation per NEC.

B. Ground System Conductor (Buried) - Soft drawn of soft annealed stranded copper, tinned bare conductor woven to form "rope-lay" type.

C. Equipment Bonding Conductor - For sizes 8 AWG and smaller, solid ASTM B1. For sizes 6 AWG and larger, stranded ASTM B8.

2.03 CONNECTORS

A. Compression-Type Fittings

1. Construction - Two bolts and a minimum of 1-1/2 inches in length.

2. Manufacturers

a. Thomas & Betts;

b. Burndy Corporation;

c. Or approved equal.

B. Welded Connection

1. Construction - Molded fusion-welding process.

2. Manufacturers

a. Cadweld;

b. Thermoweld;

c. Or approved equal.

C. Mechanical Connection

1. Construction - Mechanical lugs securely fastened using silicon bronze hardware.

2. Manufacturers:

a. Thomas & Betts;

b. Burndy Corporation;

c. Or approved equal.

PART 3 – EXECUTION

3.01 GROUND SYSTEM DESCRIPTION

A. Install ground system or grid as shown on the Contract Drawings. Install such that tops of driven ground rods are a minimum of 12 inches below grade. Ground rods are to be driven at least 2 feet below the groundwater level. Depth of the conductor system is to be 30 inches minimum with a minimum length of .20 feet. Thermoweld rods to copper,

rope-lay grounding conductor or use approved mechanical connections to rods where grounding conductor is No. 4 or smaller.

B. When rods are shown and cannot be driven due to boulders or rock formations, install grounding plates below groundwater level or a minimum of 6 feet below grade.

C. Final resistance to ground of completed ground system shall be a maximum of 5 ohms. If tests indicate higher than 5 ohms resistance, then the Contractor shall install additional rods or plates at no additional cost to Owner to lower the resistance to below 5 ohms.

3.02 CONNECTIONS

A. Buried Connection - Made with either thermal welded or compression fitting specially made for grounding systems

B. Exposed Connection - Made with grounding system compression-type fittings.

C. Connection to Metal - Make all connections to water pipes, steel surfaces, etc., using mechanical connectors.

D. Thoroughly clean all surfaces to bright bare metal to accept ground connections.

3.03 GROUNDING ELECTRODE CONDUCTOR

A. Size per NEC 250-66 unless larger size is shown or specified below:

3.04 BUILDING GROUND CONNECTION

A. Connection from main ground to building system shall be as specified herein and as required. Positively connect equipment housings and conduit system to main service ground, only at main service ground.

3.05 INDIVIDUAL GROUNDS

A. If individual equipment or individual building grounds are made, separate grounding conductors (in earth where possible) shall connect these grounds to main service ground. (This requirement applies only within each system of subsystem fed from a distribution transformer.) Intent is that main ground shall be at the main or incoming power source and not at utilization point unless positively connected to same.

3.06 INTERIOR CONDUIT AND RACEWAY SYSTEM

A. Electrical integrity of conduit system shall be maintained throughout. Provide bonding jumpers at fittings as required; jumpers shall be no longer than required. Provide separate ground wire for all conduit systems.

3.07 EXTERIOR CONDUIT AND RACEWAY SYSTEM

A. Provide separate ground wire for all conduit systems leaving the building interior. Size per NEC 250-122 in NEC.

3.08 FEEDERS

A. Include an insulated grounding conductor, sized per NEC 250-66, in each conduit. Bond all served equipment frames, enclosures, ground bars, etc., to this conductor. Make all conductor terminations and connections using compression lugs or fittings designed and UL labeled for the purposes.

3.09 SEPARATE GROUND

A. Basic intent of grounding specification is that grounding conductor be completely separate from system neutral and connect neutral to ground at the main service grounding point only. Run separate insulated (green) grounding conductors from all grounding points independently back to main service ground. Where ground passes through panels and disconnects, ground lugs shall be brazed or bolted to panel or disconnect housings with neutral bus or lug isolated from same. Ground all metallic conduits at each panel. Clean paint from metal to accept ground lugs.

3.10 METALLIC, NON-CURRENT CARRYING ENCLOSURE

A. Connect to ground bar at load center supplying same through conduit system using proper fittings at junction boxes, expansion joints, and between ground bushings on each conduit within all sheetmetal enclosures.

3.11 SHIELDED CABLE

A. Shielding to be continuous and grounded at one point only unless otherwise required by equipment manufacturer's recommendations.

3.12 CONDUIT SEALS

A. Where non-metallic conduits protecting grounding conductors enter the building from the exterior, provide watertight wall seals on each conduit and a sealing bushing on the enclosed conductor. Sealing bushings on all conduits penetrating the floor. Make bonding jumper connection to metallic conduit, where equipped with sealing bushings, with water pipe ground connections of proper size. Seal watertight the inside of all conduits.

3.13 GROUND CONDUIT LABELS

A. Label all service, equipment frame or motor grounding conduits containing only grounding conductors "_____ Ground." Label to identify item being grounded.

3.14 INDIVIDUAL MOTOR CONNECTION

A. Make connections from frames of motors over 50 HP directly to the exterior/buried ground system. Motors up to this HP shall be connected to the circuit or raceway grounding system. Where motor is separate from and not mounted on a major equipment frame, bond frame to motor ground.

3.15 MAJOR EQUIPMENT FRAMES

A. Make connection from major equipment frame, i.e., belt dewatering equipment, mechanical screens or grit equipment, directly to the exterior/buried ground system. Conductor shall be installed in conduit and full length from the grounded item to outside below grade.

3.16 CONCRETE MANHOLES

A. Provide one 5/8-inch diameter by 10-foot long ground rod in or at each manhole.

B. Provide No. 6 ground conductor from ground rod to all metallic parts including cable racks and manhole frame.

C. Bond ductbank grounds to manhole ground rod.

3.17 DUCTBANK GROUND CONDUCTOR

A. Bond ductbank ground conductor when a new building ground system was not provided, install a new ground road and bond the ductbank ground conductor to it.

B. Bond ductbank grounds to manhole ground rod, if available.

END OF SECTION

SECTION 26 05 29

ELECTRICAL SUPPORTS, ANCHORS, AND FASTENERS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Conduit and equipment supports.

2. Anchors and fasteners.

B. Related Section:

1. Section 05 50 00 – Metal Fabrications

1.02 REFERENCES

A. NECA - National Electrical Contractors Association.

B. ANSI/NFPA 70 - National Electrical Code.

1.03 SUBMITTALS

A. Manufacturer’s Instructions - Indicate application conditions and limitations of use stipulated by Product testing agency as specified under this Section. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.04 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. or other third-party testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

PART 2 – PRODUCTS

2.01 PRODUCT REQUIREMENTS

A. Materials and Finishes - Provide products which incorporate corrosion resistance adequate for the conditions in which they are to be installed.

B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products and designing system supports.

2.02 STEEL CHANNEL

A. Non-PVC Coated

1. Ductile Iron

a. Description - Hot dipped galvanized steel channel designed for use with steel fittings, spring backed washers and nuts.

b. Manufacturer:

1) Kindorf;

2) Uni-Strut;

3) B-Line;

4) Globe;

5) Or approved equal.

2. Stainless Steel

a. Description - For the purpose of this Section, all stainless steel shall be Type 304.

b. All fasteners, fittings, clamps, saddles and accessories shall be stainless steel.

c. Manufacturer:

1) Uni-Strut;

2) B-Line;

3) Or approved equal.

B. Polyvinyl Chloride (PVC) Coated Materials

1. Hanger or support shall be hot dipped galvanized including the threads.

2. The zinc surface shall be treated with chromic acid prior to coating to enhance the bond between metal and plastic.

3. All surfaces shall be coated with an epoxy acrylic primer of approximately 0.0005-inch thickness.

4. The PVC coating shall be applied by the liquid fluidized bed method.

5. The coating material shall be compounded of pure materials and shall be free of any fillers or secondary plasticizers or gross, non-uniform characteristics.

6. A PVC coating shall be bonded to the galvanized outer surface of the product. The bond between the PVC coating and the product surface shall be greater than the tensile strength of the plastic. The thickness of the PVC coating shall be a minimum of 0.040-inch (40 mils) and a maximum thickness of 0.045-inch (45 mils).

7. Finished Color - Manufacturer's standard.

8. Manufacturer:

    a. B-Line Systems, Inc.;

    b. Perma-Cote Industries;

    c. Occidental Coating Company (OCAL);

    d. Robroy Industries (Plasti-Bond Red);

    e. Or approved equal.

2.03 TWO-PIECE MALLEABLE IRON CLAMPS

A. Cast malleable iron or stainless steel strap clamp sized to match conduit with mating malleable iron clamp backs (spacers). Clamp back shall be thick enough to provide 1/4-inch standoff from conduit to wall. Cadmium-plated anchor and washer.

1. Manufacturer:

    a. O-Z/Gedney;

    b. Thomas & Betts;

    c. Appleton;

    d. Raco;

    e. Or approved equal.

B. PVC coated cast malleable iron strap clamp sized to match conduit with mating malleable iron clamp back (spacer). Clamp back shall be thick enough to provide 1/4-inch standoff from conduit to wall. Stainless steel anchor and washer.

1. Manufacturer:

    a. Robroy;

b. Thomas & Betts;

c. Ocal;

d. Perma-Cote Industries;

e. Kor Kap;

f. Or approved equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General

1. Install products in accordance with manufacturer's instructions.

2. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit. Anchor conduits to or support from structural members only.

3. Fasteners used to wall mount any material or equipment weighing 75 lbs or more to concrete or masonry shall be adhesive grouted Type 316 stainless steel anchors. All floor-mounted equipment and other wall-mounted materials or equipment weighing less than 75 lbs may be supported via drilled anchors.

4. Do not use spring steel clips and clamps.

5. Do not use powder-actuated anchors.

6. Do not drill or cut structural members.

7. Install supports in a manner that does not interfere with or weaken the bolts when attaching to structural steel. Obtain the Engineer's written approval of any drilling or cutting on the structure.

8. Through spaces where surface mounting is not available, install multiple conduits on electrical channel rack, either hung or wall mounted. Provide space on each rack for 25 percent additional conduits.

9. All hung systems with conduits 3-inch or larger shall also have lateral seismic supports at each hanger.

10. Support conduit passing through above-grade floors so that sealing sleeves or mechanical link seals do not carry the weight of the conduit.

11. Secure conduit installed in poured-in-place concrete to reinforcing bars with tie wires. Install suitable brackets secured to forms in the absence of reinforcing bars.

12. Install individual surface-mounted conduit with two-piece cast malleable iron clamp assembly.

13. Install surface-mounted cabinets and panelboards with minimum of four or six anchors, depending upon the number of normal anchor points. See table at the end of this Section.

14. In wet and damp locations use PVC-coated steel channel supports to stand cabinets, panelboards and mounting panels 1/2-inch (12 mm) off wall.

15. Finish of all supports shall be compatible with the conduit system applicable for the area classification where installed.

16. After thorough investigation of architectural, structural and shop drawings related to work to determine how equipment, fixtures, conduit, panelboards, etc. are to be supported, mounted or suspended, provide:

    a. Extra steel bolts, inserts, pipe stands, brackets, or any other items required for proper support.

    b. Supporting accessories where required, whether or not shown on Drawings.

17. Refer to details on the Contract Drawings for free standing and railing mounted construction and for any other details of special conditions. For other situations, the Contractor shall, prior to installation, submit mounting details to the Engineer for approval.

18. Fasteners, brackets and supports shall be fabricated in accordance with Section 05 50 00 – Metal Fabrications, and as specified herein.

19. Coat field cuts of PVC-coated support members with matching PVC material to thickness of system coating. File smooth all cuts prior to coating.

B. In areas where spray insulation is to be applied, install steel channel standoffs for electrical conduit, boxes and enclosures prior to installation of insulation.

    1. Provide conduit extensions to all boxes and enclosures. Install connecting conduit, boxes and/or enclosures over the installed insulation.

C. Support Applications

    1. Unclassified Areas - Galvanized steel channel system or malleable iron clamps.

    2. Interior Corrosive Areas - Fiberglass reinforced plastic channel system.

3. Interior Wet Areas - Stainless steel channel system.

4. Hazardous Areas - PVC-coated galvanized steel channel system.

5. Exterior Areas - Stainless steel channel system.

D. Anchor and Fastener Application Schedule - See schedule at end of this Section.

E. Support Spacing

1. Metallic Conduit - Not more than 8 feet on center. Types A, A-1, B, E, E-1 within 3 feet of each outlet box, junction box, cabinet or fitting. Type C, within 18 inches of box or fitting. Support boxes, fittings, or cabinets independent of conduit system.

2. Non-Metallic Conduit

   a. Sizes up through 1-1/4-inches diameter - not more than 3 feet on center.

   b. Sizes 1-1/2-inches diameter and larger - Not more than 4 feet on center.

   c. Within 18 inches of each outlet box, junction box, cabinet or fitting.

3. Maximum Deflection

   a. Metallic Conduit - 1/100th of span between supports.

   b. PVC Conduit - 1/360th of span between supports.

ANCHOR AND FASTENER APPLICATION SCHEDULE

Item Category	Mounting Surfaces					
	Wood, Plywood	Wallboard, Gypsum, FRP, Composition	Hollow Masonry	Solid Masonry	Cast Concrete	Sheet Metal
Individual Conduit	F	G	D	A	A	E
Steel/FRP Channel	F, I	D	D	A	A	E
Structures (i.e., Conduit Rack, Cable Tray)	F, I	D	D	A	A	--
Devices and Equipment Less than 75 lbs.	I	Note 1	D	A	A	Note 2
Devices and Equipment 75 lbs. or More (Note 4)	I	Note 2	H	B, H	B, C, H	Note 2
Mounting Panels (Note 3)	I	Note 1	D	B, H	B, C, H	Note 2

Key to Anchor Types:
A = Drilled (lead insert in masonry, expansion bolt in concrete)
B = Adhesive grouted anchor
C = Cast in place insert
D = Toggle bolt, hollow wall fastener
E = Sheet metal screw
F = Wood screw
G = Sheet rock screw
H = Through bolt
I = Lag screw

In wet, exterior, corrosive, or hazardous areas, all fasteners and anchors shall be Type 316 stainless steel. In all unclassified areas, cadmium-plated fasteners shall be used, except grouted anchors shall be Type 316 stainless steel.

Notes:

1) Support via plywood mounting panel lagged to studs or via electrical channel lagged to studs.
2) Do not mount to these surfaces.
3) Panels mounted to masonry or concrete surfaces shall have 1/2-inch air space between surface and panel via stainless steel spacers.
4) Provide two additional support connections; minimum of four or six, depending on number of normal connection points. This requirement may necessitate fabricating the additional connections. Maintain NEMA rating of enclosure.

END OF SECTION

SECTION 26 05 60
LOW-VOLTAGE ELECTRIC MOTORS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish all labor, materials, tools and equipment necessary for furnishing, installing, connecting, testing and placing into satisfactory operation all low voltage electric motors as shown on the Drawings and specified herein. All motors required for this Contract shall comply with this Section unless otherwise noted.

B. Related Sections:

1. Section 01 33 00 – Submittal Procedures

2. Section 09 90 00 – Painting

3. Section 26 00 10 – Electrical Work.

1.02 CODES AND STANDARDS

A. Motors and related accessories shall be designed, manufactured, and/or listed to the following standards as applicable:

1. Institute of Electrical and Electronics Engineers (IEEE)

   a. IEEE 112 – Standard Test Procedure for Polyphase Induction Motors and Generators

2. National Electrical Manufacturer's Association (NEMA)

   a. NEMA MG 1 – Motors and Generators

3. Underwriters Laboratories (UL)

   a. UL 547 – Standard for Safety Thermal Protectors for Motors

   b. UL 674 – Electric Motors and Generators for Use in Hazardous (Classified) Locations

   c. UL 1004-1 – Standard for Rotating Electrical Machines

   d. UL 1004-3 – Standard for Thermally Protected Motors

   e. UL 1004-8 – Standard for Inverter Duty Motors

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1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01 33 00 – Submittal Procedures, the Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings.

2. Spare Parts List.

B. Each submittal shall be identified by the applicable Specification Section.

1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Individual shop drawings for electric motors shall be submitted in accordance with the procedures and requirements set forth in the General Conditions and Section 01 33 00 – Submittal Procedures, unless submitted as a part of the shop drawings for the driven equipment.

D. Shop drawings for electric motors shall include motor data sheets, dimensioned drawings, wiring diagrams for devices such as space heaters, temperature devices, and shaft grounding rings. Shop drawings shall identify electric characteristics and design, mechanical construction, manufacturer's name, type and pertinent specifications for the use intended, along with the name of the equipment to be driven. For motors rated 50 horsepower or greater, submittal of motor data for acceptance shall include, as a minimum, the following:

1. Manufacturer's type and frame designation

2. Horsepower rating

3. Time rating (per NEMA Standards)

4. Ambient temperature rating

5. Motor winding insulation system designation

6. RPM at rated load

7. Frequency

8. Number of phases

9. Rated-load amperes

10. Voltage

11. Code letter (starting KVA per horsepower)

12. Design letter for integral horsepower induction motors (per NEMA Standards)

13. Service factor

14. Temperature rise at full load and at service factor load

15. Efficiency at 1/4, 1/2, 3/4 and full load

16. Power factor at 1/4, 1/2, 3/4 and full load

17. Motor outline, dimensions and weight

18. Motor winding insulation system description

19. Horsepower required by connected machine at specified conditions (load curves) shall be supplied for all compressors, propeller and positive displacement pumps.

20. The foregoing data shall also be verified after manufacture and shall be included with the information to be furnished in the operation and maintenance manuals specified.

E. The shop drawing information shall be complete and organized in such a way that the Engineer can determine if the requirements of these Specifications are being met. Copies of technical bulletins, technical data sheets from "soft-cover" catalogs, and similar information which is "highlighted" or somehow identifies the specific equipment items the Contractor intends to provide are acceptable and shall be submitted.

1.05 SPARE PARTS

A. All spare parts as recommended by the equipment manufacturer shall be furnished to the Owner by the Contractor.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. The equipment covered by this Section is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed,

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constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

B. Electric motors shall be manufactured by:

1. Baldor/Reliance Electric Company;

2. Nidec Motors;

3. Toshiba Industrial and Power Systems, Inc.;

4. Siemens Energy & Automation, Inc.;

5. GE Industrial Motors;

6. Or approved equal.

2.02 MATERIALS AND CONSTRUCTION

A. Motors shall be built in accordance with the latest standards of NEMA, including, but not limited to MG-1 and MG-2, IEEE, ANSI and to the requirements specified herein.

B. Type

1. Unless otherwise noted, motors specified herein shall be polyphase squirrel cage, NEMA Design B, or single phase capacitor or repulsion start induction motors. Special equipment requiring a motor drive with unusual characteristics shall be equipped with a definite purpose motor to meet the necessary requirements.

2. Unless otherwise shown or specified, all motors 1/2 horsepower or larger shall be three- phase, 60 Hertz, NEMA Design B, squirrel cage induction motors designed for operation at 480 volts or greater as specified herein or shown on the Drawings.

3. Unless otherwise specified in the individual equipment specification for the driven equipment, or as required by the dynamic characteristics of the load as determined by the manufacturer of the machine to be driven, all polyphase squirrel cage motors shall be designed to withstand the starting voltage shown on the Drawings and shall have torque and locked rotor current characteristics as specified for NEMA Design B motors.

4. All motors 2 horsepower and smaller shall have windings encapsulated with a flexible epoxy compound, or insulated with a flexible epoxy compound, or insulated with the manufacturer's premium quality system which shall be subject to acceptance by the Engineer.

5. Unless otherwise noted, all motors smaller than 1/2 horsepower shall be standard single-phase capacitor start or repulsion start induction type designed for operation

on 120 volts or 208 volts, 60 Hz alternating current. The motor shall deliver rated load without exceeding an 80 degrees C temperature rise while operating in a 40 degrees C ambient temperature. Small fan motors less than 1/4 HP may be split-phase or shaded pole type. Shaded pole motors rated more than 1/4 horsepower are not acceptable. Fractional horsepower motors shall be completely equipped with all necessary auxiliary components for starting and labeled as "Thermally Protected". Insulation shall be Class B, except that submersible motors shall have epoxy encapsulation. Unless otherwise noted, the motors shall be totally enclosed. Small fan motors may be of the open type where they are suitably protected from moisture dripping and lint accumulation. Motors shall be provided with sealed ball bearings lubricated for 10 years of normal use.

C. Rating

1. Each motor shall develop ample torque for its required service through its acceleration range and throughout its rated load range. The rating of the motors offered shall in no case be less than the horsepower shown on the Drawings or elsewhere specified. It should be noted that the motor sizes indicated on the Drawings or as otherwise specified herein, are motor sizes required to operate the specific equipment which is specified. Higher rated motor sizes may be determined from the actual equipment submitted, approved, purchased, and installed. Protective devices, motor starters, disconnect switches, and other necessary equipment shall be furnished and installed for the actual motor sizes required at no additional cost.

2. Motor ratings shall be based on continuous operation. The maximum temperature rise for open and drip proof type motors shall not exceed 90 degrees C, and for totally enclosed type motors shall not exceed 80 degrees C.

D. Motor Winding Insulation

1. Insulation shall be as specified for each particular type or class of motor. The insulation system shall provide a high dielectric strength, long life covering for the windings which may be required to operate in a continually damp, corrosive, and/or chemically contaminated environment. The insulation shall be resistant to attack by moisture, acids, alkalies, abrasives, and mechanical and thermal shock. Leads shall be sealed with a non-wicking, non-hydroscopic insulation material.

2. Motor insulation resistance may be checked at any time after delivery to the job site or during the warranty period. Encapsulated motor stators may be subjected to insulation testing while completely submerged in water. Any motor not meeting the requirements specified herein will be rejected and shall be promptly replaced at no cost to the Owner.

3. Torque and locked rotor current characteristics for three phase motors shall be NEMA Design B. The locked rotor KVA/HP input at full voltage for 10 horsepower.

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motors and larger shall not exceed that permitted for Code Letter "J", except for specialized equipment requiring a motor drive with special definite characteristics.

4. Unless otherwise specified, non-inverter duty motors shall be furnished with a Class F insulation system. Unless otherwise specified, inverter duty motors shall be furnished with a Class H insulation system. In either case, temperature rise shall be limited to that for Class B insulation. Output torque and speed characteristics of each motor shall be suitable to operate the driven equipment through the full range of acceleration and operating load conditions without exceeding the nameplate current rating, and/or temperature rise.

E. Nameplates

1. The motor manufacturer's nameplate shall be engraved, embossed, or stamped on a stainless steel sheet and fastened to the motor frame with No. 4 or larger oval head stainless steel screws or drive pins. Printed or laser-etched nameplates are not acceptable.

2. Nameplates shall include as a minimum, Items 1 through 14 as listed in Article 1.04 D in addition to that required by NEMA standards. The nameplate shall be positioned so as to be readily visible for inspection as installed in the facility.

F. Design

1. Motors shall be designed to accelerate and drive the connected equipment under all normal operating conditions without exceeding nameplate ratings.

2. Motors specified for operation with variable frequency drives shall be inverter duty rated. Motors shall be considered inverter duty rated only if they meet all of the requirements for NEMA MG-1 Part 31.

3. Motors shall be designed to output 100 percent of nameplate horsepower under continuous duty service without exceeding the temperature rise specified herein when controlled by the actual drives furnished. Inverter duty motors shall be designed to operate down to 10% of full load speed without the need for a line powered cooling fan.

4. Unless otherwise specified, electric motors shall be furnished with service factors in accordance with NEMA MG-1 as follows:

Type of Motor	Service Factor
Non-inverter Duty	1.15
Inverter Duty	1.0

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5. Design selection with respect to the driven machine shall be such that the requirements do not exceed 85 percent of the motors' maximum rating modified by service factor, ambient temperature, enclosure, altitude and electrical service. The electrical service conditions shall be assumed to be 10 percent undervoltage, 5 percent underfrequency, and 3 percent voltage unbalance. Altitude shall be assumed to be the project site elevation plus 10 percent. Ambient temperature shall be assumed to be 95 degrees F in exterior locations, 104 degrees F (40 degrees C) in interior locations, and 122 degrees F (50 degrees C) within housings or enclosures; except where higher temperatures may be encountered within or on individual items of equipment. The applicable paragraphs of NEMA MG-1 shall be used in making the design selection.

6. Motors used with belt drives shall have sliding bases to provide for belt take up.

7. Terminal boxes shall be of sufficient size to accommodate the required quantity and size of conduits. Gasketed terminal boxes shall be furnished with all splash-proof and totally enclosed motors. NEMA ratings of the terminal boxes shall be suited for the application. Motors located in hazardous locations shall be furnished with terminal boxes suitable for the specific Class, Division, and Group suitable for the application. Terminal boxes shall be sized to accommodate accessory equipment such as motor differential current transformers, where required.

8. Terminal boxes for horizontal motors shall be located on the left-hand side when viewing the motor from the drive shaft end and shall be so designed that conduit entrance can be made from above, below, or either side of the terminal box.

G. Construction

1. Frames, mounting means, and shafts shall meet NEMA Standards for the horsepower, RPM, and enclosure selected. Enclosures shall be selected according to the degree of mechanical protection required and shall not be of aluminum construction. All motors shall have a manufacturer's standard shop machinery finish, consisting of a rust-resisting priming coat of zinc chromate and a finish coat of alkyd machinery enamel. Reference Section 09 90 00 – Painting.

2. Motors shall have cast iron frames and a heavy gauge steel terminal box, with neoprene gaskets between the frame and the box and between the box and its cover. A grounding lug(s) shall be provided inside the terminal box.

3. Motors weighing more than 50 pounds shall be equipped with at least one lifting eye. All lifting hardware shall be corrosion resistant.

4. Motors located in hazardous locations shall be totally enclosed and suitable for the specific Class, Division, and Group suitable for the application.

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5. Motors located in Class I or II, Division 1 hazardous locations shall bear a U.L.-674 label and shall be provided with a breather/drain approved for the hazardous location. The U.L. listed breather/drain shall prevent the entrance of contaminants while allowing moisture to drain out of the motor.

6. When located outdoors, or elsewhere if specified, motors shall be totally enclosed, non-ventilated (TENV) or totally enclosed, fan-cooled (TEFC) machines, unless otherwise noted. Totally enclosed motors shall be provided with two (2) 1/4 inch drain holes drilled through the bottom of the frame, which allows complete drainage of the frame. Where specified, TEFC motors controlled by a variable frequency drive shall be provided with a separately powered cooling fan motor that runs at 60HZ to ensure proper cooling of the motor at low speeds. Cooling fan motor shall be suitable for 120VAC, single phase operation. Vertically oriented motors located outdoors shall be provided with a drip cover over the fan end to prevent accumulation of precipitation.

7. Unless otherwise specified in the equipment specifications, motors rated less than 200HP that are controlled by a VFD shall be furnished with motor winding high temperature switches embedded in the stator windings with the leads brought out to the motor terminal box.

8. If so specified and when located in indoor areas which are heated and weatherproof, motors shall be open drip-proof machines. Ventilation openings shall be arranged to prevent the entrance of drops of liquid or solid particles at any angle from zero to 15 degrees downward from vertical.

9. Unless otherwise specified, or required, motors rated less than 200 horsepower shall be furnished with bearings of the grease lubricated, antifriction ball type with conveniently located grease fittings and drain plugs. A means of preventing bearings from becoming over-greased shall be provided. Bearings shall have a minimum B-10 life of 20,000 hours.

10. Rotors shall be statically and dynamically balanced. Rotor windings shall be one-piece cast aluminum. Where applicable, rotors shall be constructed with integral fins.

11. Externally mounted motor shaft grounding rings shall be provided to protect motors against motor shaft and bearing currents. Grounding rings shall be provided for all motors controlled by VFDs, with the following exceptions:

    a. Motors located in hazardous areas

    b. Motors rated less than 1 horsepower

    c. Submersible motors

12. All motors shall be provided with factory-installed one-hole terminations (ring terminals) on the ends of all motor leads. Terminations shall be identified for use with cables that have stranding other than Class B and shall be the irreversible compression type.

H. Power Factor and Efficiency

1. All motors in the range of 1-500 horsepower, inclusive, shall be designed specifically for energy efficiency and high power factor. The motor efficiency and power factor shall meet or exceed the values listed in the table below when the motors are tested in accordance with the NEMA preferred test method IEEE 112A, Method B, Dynamometer. Each motor shall meet the minimum guaranteed efficiency value indicated in the table below. All tests shall be performed in accordance with the procedures contained in NEMA Standard MG1-12.58.

Table 12-11
FULL-LOAD EFFICIENCIES OF ENERGY EFFICIENT MOTORS
ENCLOSED MOTORS

HP	2 POLE		4 POLE		6 POLE		8 POLE	
	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency
1	75.5	72	82.5	80	80	77	74	70
1.5	82.5	80	84	81.5	85.5	82.5	77	74
2	84	81.5	84	81.5	86.5	84	82.5	80
3	85.5	82.5	87.5	85.5	87.5	85.5	84	81.5
5	87.5	85.5	87.5	85.5	87.5	85.5	85.5	82.5
7.5	88.5	86.5	89.5	87.5	89.5	87.5	85.5	82.5
10	89.5	87.5	89.5	87.5	89.5	87.5	88.5	86.5
15	90.2	88.5	91	89.5	90.2	88.5	88.5	86.5
20	90.2	88.5	91	89.5	90.2	88.5	89.5	87.5
25	91	89.5	92.4	91	91.7	90.2	89.5	87.5
30	91	89.5	92.4	91	91.7	90.2	91	89.5
40	91.7	90.2	93	91.7	93	91.7	91	89.5
50	92.4	91	93	91.7	93	91.7	91.7	90.2
60	93	91.7	93.6	92.4	93.6	92.4	91.7	90.2
75	93	91.7	94.1	93	93.6	92.4	93	91.7
100	93.6	92.4	94.5	93.6	94.1	93	93	91.7
125	94.5	93.6	94.5	93.6	94.1	93	93.6	92.4
150	94.5	93.6	95	94.1	95	94.1	93.6	92.4
200	95	94.1	95	94.1	95	94.1	94.1	93
250	95.4	94.5	95	94.1	95	94.1	94.5	93.6
300	95.4	94.5	95.4	94s.5	95	94.1		

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Table 12-11
FULL-LOAD EFFICIENCIES OF ENERGY EFFICIENT MOTORS
ENCLOSED MOTORS

HP	2 POLE		4 POLE		6 POLE		8 POLE	
	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency
350	95.4	94.5	95.4	94.5	95	94.1		
400	95.4	94.5	95.4	94.5				
450	95.4	94.5	95.4	94.5				
500	95.4	94.5	95.8	95				

Table 12-12
FULL-LOAD EFFICIENCIES FOR NEMA PREMIUM™ EFFICIENCY ELECTRIC MOTORS
RATED 600 VOLTS OR LESS (RANDOM WOUND)
OPEN MOTORS

HP	2 POLE		4 POLE		6 POLE	
	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency
1	77	74	85.5	82.5	82.5	80
1.5	84	81.5	86.5	84	86.5	81.5
2	85.5	82.5	86.5	84	87.5	81.5
3	85.5	82.5	89.5	84	88.5	86.5
5	86.5	84	89.5	84	89.5	87.5
7.5	88.5	86.5	91	89.5	90.2	88.5
10	89.5	87.5	91.7	90.2	91.7	90.2
15	90.2	88.5	93	91.7	91.7	90.2
20	91	89.5	93	91.7	92.4	91
25	91.7	90.2	93.6	92.4	93	91.7
30	91.7	90.2	94.1	93	93.6	92.4
40	92.4	91	94.1	93	94.1	93
50	93	91.7	94.5	93.6	94.1	93
60	93.6	92.4	95	94.1	94.5	93.6
75	93.6	92.4	95	94.1	94.5	93.6
100	93.6	92.4	95.4	94.5	95	94.1
125	94.1	93	95.4	94.5	95	94.1
150	94.1	93	95.8	95	95.4	94.5
200	95	94.1	95.8	95	95.4	94.5
250	95	94.1	95.8	95	95.4	94.5
300	95.4	94.5	95.8	95	95.4	94.5

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Table 12-12
FULL-LOAD EFFICIENCIES FOR NEMA PREMIUM™ EFFICIENCY ELECTRIC MOTORS
RATED 600 VOLTS OR LESS (RANDOM WOUND)
OPEN MOTORS

HP	2 POLE		4 POLE		6 POLE	
	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency
350	95.4	94.5	95.8	95	95.4	94.5
400	95.8	95	95.8	95	95.8	95
450	95.8	95	96.2	95.4	96.2	95.4
500	95.8	95	96.2	95.4	96.2	95.4

2. Motors rated 50 horsepower or greater shall be individually tested at the factory before shipment, with a copy of test results provided for the Engineer, to assure compliance with the efficiency and power factor specifications.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Motors shall be installed as shown on the Drawings and in accordance with the manufacturer's installation instructions.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Motors shall be properly protected from weather hazards. Motors shall not be allowed to be wrapped tightly in plastic while outdoors. Motors delivered to the site which will not be put in service for a time in excess of 30 calendar days, whether in storage or installed, shall have the shafts rotated a minimum of five (5) rotations every 30 days.

B. Motors provided with space heaters shall have temporary power applied to the heaters no later than 30 calendar days after delivery to the site until permanent power can be applied to the heaters.

C. Motors that, in the opinion of the Engineer, have not been properly protected shall be inspected by the manufacturer's representative. Any required electrical corrections for testing shall be made at the Contractor's expense prior to acceptance and/or use.

D. All motors shall operate without any undue noise or vibration and shall show no signs of phase unbalance.

3.03 TESTING

A. All tests shall be performed in accordance with the requirements of the General Contract Conditions, Special Contract Conditions, and Division 01. The following tests are required:

1. Shop Tests

a. All motors shall be shop tested and inspected in accordance with the equipment manufacturer's standard procedures. The manufacturer's testing and inspection procedures shall demonstrate that the equipment tested conforms to the requirements specified, all other applicable requirements, and shall be approved by the Engineer.

b. In addition to the efficiency and power factor testing specified herein, each motor shall be tested to determine compliance with the applicable requirements of the IEEE, ANSI and NEMA. Tests shall be as follows:

1) Motors less than 50 HP:

a) Each motor shall be subjected to a standard, short commercial test including the following:

i. Running current, no load

ii. Locked rotor current

iii. High potential

iv. Winding resistance

v. Bearing inspection

2) Motors between 50 and 100 HP

a) Each motor shall be subjected to the above tests and shall be furnished with certified test results.

3) Motors larger than 100 HP

a) Each motor shall be furnished with certified test results. Each motor shall be subjected to a complete test consisting of full load heat run, percent slip, running load current, locked rotor current, breakdown torque (calculated), starting torque, winding resistance, high potential, secondary current and voltage at collector rings (wound rotor), efficiencies at 100, 75 and 50 percent of full load, power factors at 100, 75 and 50 percent of full load and bearing inspection. Tests will be witnessed by the Engineer where specifically indicated.

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4) Test Reports

a) All test results for motors over 100 horsepower shall be submitted to the Engineer for approval. Copies of witnessed test raw data shall be submitted to the Engineer immediately upon completion of such tests.

2. Field Tests

a. Field tests shall be performed in accordance with the requirements specified in the General Contract Conditions, Division 01, and Section 26 00 10 – Electrical Work.

b. All electric motors furnished for this project one (1) horsepower or larger shall have the information required in the following tabulation completed. See Exhibit "A" on following page.

c. All field testing shall be witnessed by the Engineer.

(EXHIBIT A)

MOTOR TEST RECORD					
Motor Identification Remarks	**Location**	**Specified Horsepower**	**Nameplate Horsepower**	**Nameplate Amperage (FLA)**	**Measured Amperage Under Normal Operating Conditions**

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END OF SECTION

NO TEXT ON THIS PAGE

SECTION 26 08 00
TESTING AND INSPECTION

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Electrical power distribution and control circuit testing.

2. Exhibits:

a. Exhibit A - Testing and Inspection Electrical Insulation Test Record: Insulation Resistance Test

b. Exhibit B - Testing And Inspection Test Record: Thermographic Termination Test

B. Related Section:

1. Section 01 33 00 – Submittal Procedures

2. Section 01 77 19 – Closeout Requirements

3. Section 26 00 10 – Electrical Work

1.02 SUBMITTALS

A. Made in accordance with Section 01 33 00 – Submittal Procedures, Section 26 00 10 – Electrical Work, and as specified herein.

B. Submit test records and reports for all testing.

1.03 CERTIFICATION OF TESTING

A. Perform all tests in the presence of a duly authorized representative of the Owner unless waived in writing by the Engineer. When the presence of such a representative is waived, certified results of the tests made and the results thereof shall be furnished by the Contractor.

B. Perform all tests in the presence of the Engineer. Give the Engineer written notice of all tests at least two weeks in advance.

1.04 TEST EQUIPMENT

A. Furnish all instruments and a qualified engineer to properly perform all tests required.

1.05 FACTORY-TRAINED SUPERVISION

A. Provide necessary factory trained supervision to check over equipment for proper functioning before putting the equipment into operation as may be required by these specifications. This shall include establishing a simulated fault on checking out the coordination of the protective devices.

B. Make necessary adjustments and testing in cooperation with the respective manufacturers and other Contractors when necessary. Perform all tests in accordance with the latest standards of the ANSI, IPCEA, IEEE and NEMA.

1.06 COSTS

A. Costs of all tests shall be borne by the Contractor and shall be included in the Contract price.

1.07 DAMAGES

A. If damage is indicated or observed during testing or from the review of tabulated data, replace defective or damaged materials and retest at no cost to the Owner.

PART 2 – MATERIALS

2.01 TESTING EQUIPMENT

A. Furnish all test equipment required to correctly perform the system tests.

2.02 SPECIAL EQUIPMENT REQUIREMENTS

A. 500-volt dc Megger - For maximum 300-volt systems.

B. 1,000-volt dc Megger - For maximum 600-volt systems.

PART 3 – EXECUTION

3.01 GENERAL

A. After completion of the work, thoroughly test the entire electrical system, including electrical work required for instrumentation, control and power, and adjust electrical system as required.

B. Test all electrical circuits to ensure circuit continuity, insulation resistance, proper splicing, and freedom from improper grounds.

C. System performance test runs are required. Coordinate test runs of electrical systems with test runs of equipment served thereby (i.e., mechanical, heating, air conditioning, process systems and plumbing).

3.02 GENERAL TESTING METHODS

A. Panels - Test each panel with mains disconnected from the feeder, branches connected, branch circuit breakers closed, all fixtures in place and permanently connected, lamps removed or omitted from the sockets, and all wall switches closed.

B. Feeders - Test with the feeders disconnected from the panels.

C. Individual Power Circuits - Test each individual power circuit at the panel or motor control center with the power equipment connected for proper operation.

D. Transformers (Low Voltage) - Megohmmeter test all transformers in accordance with the manufacturer's recommendations.

E. Lighting and receptacle circuits do not need to be megger tested.

3.03 EQUIPMENT TESTING (600 VOLTS AND BELOW)

A. Megohmmeter Tests

1. Conduct megohmmeter tests of the insulation resistance of rotating machines and power distribution feeders down to panelboard feeders. The results will be accepted when the megger shows the insulation resistance to be not less than 50 megohms at 20 degrees C using either a 500-volt or 1,000-volt megger. Wait 1 minute between each test for all conductors in the same enclosure and each conductor and ground.

2. Perform megohmmeter testing (Insulation Resistance Test) of all motor power and control wiring after the cables are in place and just prior to final terminations. Record all data as per **Exhibit A**. Lighting and receptacle panelboard branch circuits are not megohmmeter tested.

B. Voltage and Amperage Testing

1. Check all single and three phase motor amperage while the unit is running at as close to operating load as possible. Record voltage on each line and the amp draw for each leg. Provide results in a typed report format and submit as part of the Contractor's closeout package.

2. Check the load current in each phase of each distribution, lighting and receptacle panelboard feeder and make modifications to the circuit loading to correct load unbalance to within 1 kVA phase to phase for each panelboard.

3.04 GROUNDING SYSTEM

A. Test the grounding system to verify a resistance to ground of 5 ohms or less. If the resistance is greater than 5 ohms, modifications shall be made to the system by adding additional ground rods or plates to bring the resistance test value to 5 ohms or less. Submit a record/report to the Engineer. Include the following.

1. Time, date, temperature, frost information depth (if applicable), and weather conditions.

2. Moisture content of earth at time of measurement (wet, dry, etc.).

3. Ground test equipment, model numbers, and last date of calibration.

4. Detailed description of method used.

5. Plot of “distance from ground grid versus resistance.” Resistances shall range from 0-50 ohms with enough points to produce a smooth curve.

6. Maintenance information and recommendations (if applicable).

B. Test all grounding conductors and grounding systems for continuity. Where continuity does not exist, conditions will be corrected by an approved method and the system retested.

3.05 SYSTEM LOAD BALANCING

A. Check the load current in each phase of each distribution panel feeder and make modifications to the circuit loading to correct load unbalance to within 1 kVA phase to phase for distribution panels.

3.06 SYSTEM CHECKS

A. Preliminary

1. Connect all motors to protective devices and controls to give proper motor acceleration and correct motor rotation. Interconnect the control wiring to all the control devices associated with a machine, a group of machines, or other device to produce the correct operation, timing, and/or sequencing of the equipment.

2. Adjust overload elements in motor starters and check for coordination with the actual installed motor characteristics. Replace any overload element that is inadequate.

3. Check all motor nameplates for verification of proper voltage, horsepower, speed, phase, and power factor.

4. Check all power and controls wiring from point-to-point. Check wiring for continuity, document all results.

B. Operational

1. Then give the equipment an operational test to determine that all components including motors, controls, protective and switching devices, and auxiliary associated equipment are in operable condition and can function as described and shown on relevant specifications, operating instructions, and drawings.

2. Take motor current reading at full load or as close to full load as the driven machine will develop. If the ammeter reading is over the rated full load current or the proper current for the load at which the machine was operated, determine the reason for the discrepancy and take the necessary corrective action.

3. Remove the cause of any motor operating above full load rating instead of increasing the overload relay trip rating.

3.07 CLOSEOUT PROCEDURES

A. General - Sequence closeout procedures so that work will not be endangered or damaged, and so that every required performance will be fully tested and demonstrated. Closeout shall be in accordance with Section 01 77 19 – Closeout Requirements, and as required herein.

B. Final Operational Check - Make a check of each item in each system to determine that it is set for proper operation. With the Engineer present, operate each system in a test run of appropriate duration to demonstrate compliance with performance requirements. During the following test runs, make final corrections or adjustments of systems to refine and improve performances where possible, including noise and vibration reductions, elimination of hazards, better response of controls, signals and alarms, and similar system performance improvements. Provide testing or inspection devices to permit observation of actual system performances and shall demonstrate that controls and items requiring service or maintenance are accessible.

C. Cleaning and Lubrication - After final performance test run of each electrical system, clean system both externally and internally, comply with manufacturer’s instructions for lubrication of both power and hand operated equipment, and remove excess lubrication, touch up minor damage to factory-painted finishes and other painting specified as electrical work, and refinish work where damage is extensive.

D. Operating Instructions - General operating instructions are required. In addition to specific training of the Owner’s operating personnel specified in the individual Sections, and in addition to preparation of written operating instructions and compiled maintenance manuals specified elsewhere in these specifications, provide general operating instructions for each operational system and equipment item of electrical work,

and coordinate instructions with instructions for mechanical work, and other equipment where associated with electrical systems or equipment.

E. System Description and Operation

1. Perform in the presence of the Owner, the Owner's operating personnel and the Engineer.

2. Describe each basic electrical system and explain identification system, displayed diagrams, signals, alarms and audio-visual provisions.

3. Describe interfaces with mechanical equipment, including interlocks, sequencing, startup, shutdown, emergency, safety, system failure, security, and similar provisions.

4. In the presence of the Owner's personnel, display and conduct a "thumb-through" explanation of maintenance manuals, record drawings, spare parts inventory, storage and extra materials, meter readings, and similar service items.

3.08 CONTINUED SYSTEM OPERATIONS SUPPORT

A. Coordinate the Owner's takeover of electrical systems with takeover of mechanical systems, including the provision of skilled electrical operating and maintenance personnel until the time the Owner's personnel take over operation of entire mechanical and electrical plant. Respond promptly with continued consultation and services (beyond takeover date) on electrical systems, matching required continued services on associated mechanical systems and equipment until the end of the warranty period.

3.09 DOCUMENTATION PROCEDURE

A. Signed commitments are required. The transfer of electrical systems to the Owner for operation will not proceed until guarantees, warranties, performance certifications, maintenance agreements and similar commitments to be signed by Contractor and other entities have been executed and transmitted to and accepted by the Engineer for placement in the Owner's records.

3.10 THERMOGRAPH INSPECTIONS

A. Perform thermograph inspections on all service terminations, subfeed terminations, major power splices, and motor terminations for motors 5 HP or larger. Testing on major power distribution equipment will be performed with the plant running at a minimum of 70 percent capacity or the highest load that can be operated. Testing on individual pieces of equipment will be performed while the unit is operational at rated load and has operated for at least 30 minutes for continuously operated equipment or near the end of a cycle for equipment that operates on/off. Loads shall be minimum of 40 percent of full load. Readings at overcurrent devices and starters will be for line and load; motors will

be connections in motor terminal boxes; and for transformers, primary and secondary terminations. Provide a report of test results to the Owner including indication of any actions taken to resolve abnormal readings. See **Exhibit B** at the end of this Section. All thermographic tests shall be reported on this form.

(continued)

EXHIBIT A

TESTING AND INSPECTION: ELECTRICAL INSULATION TEST RECORD

INSULATION RESISTANCE TEST

Equip. I.D. CKT/Mark No.	Test Voltage	Phase to GND. Meg Ohms				Phase to Phase Meg Ohms						Date Tested
		A	B	C	N	A-B	A-N	B-C	B-N	C-A	C-N	

TEST EQUIPMENT CONTROL NO. _____ _____ _____

REMARKS: _____

_____

PERFORMED BY: _____DATE: _____

APPROVED BY: _____DATE: _____

Test Engineer

EXHIBIT B

TESTING AND INSPECTION: TEST RECORD

THERMOGRAPHIC TERMINATION TEST

Equipment	Ambient[1]	Line/Primary			Load/Secondary			Load Condition (% of Full)	Comments[2,3]
		1	2	3	1	2	3		

Thermograph Model

Date of Test _____ Conducted by

Outdoor Temperature _____ Room Temperature

Owner/Engineer Witness

(1) Ambient is the breaker case temperature, transformer winding temperature, or motor housing temperature. For bus or cabling, it shall be the temperature of the bus or cable a minimum of 24 inches from the splice or termination.

(2)

Temperature Difference	Condition	Action
1°C to 3°C	Possible Deficiency	Investigate (i.e., clean terminations/retorque)
4°C to 15°C	Deficiency	Determine problem and repair; retest
16°C and above	Major Deficiency	Immediate shutdown; determine problem and repair and retest

(3) Indicate any discrepancies the cause of any temperature differences and indicate action to be taken.

Test Parameters:

- Imaging equipment shall be capable of detecting a minimum temperature difference of 1 degree at 30 degrees C.
- Equipment shall detect and convert emitted radiation to a visual signal.
- Tests to be run during periods of maximum possible loading, but at least 40 percent of rated load.

END OF SECTION

SECTION 26 09 16
AUXILIARY CONTROLS AND RELAYS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Pushbutton.
2. Selector switches
3. Indicating pilot lights.
4. Contact blocks.
5. Control power transformers.
6. Fuse blocks.
7. Limit switches.
8. Time delay relays.
9. Relays.
10. Intrinsically safe barriers.

B. Related Sections:

1. Section 01 33 00 – Submittal Procedures
2. Section 26 00 10 – Electrical Work
3. Section 26 27 16 – Control Panels and Enclosures

1.02 REFERENCES

A. NEMA ICS 1 – General Standards for Industrial Control System

B. NEMA ICS 2 – Standards for Industrial Control Devices, Controllers, and Assemblies

C. NEMA ICA 6 – Enclosures for Industrial Controls and Systems

D. NEMA ST 1 – Standard for Specialty Transformers (Except General Purpose Type)

1.03 SUBMITTALS

A. Submit shop drawings under provisions of Section 01 33 00 – Submittal Procedures.

B. Submit shop drawings to NEMA ICS 1 indicating control panel layouts, wiring connections and diagrams, dimensions, support points.

C. Submit product data under provisions of Section 01 33 00 – Submittal Procedures.

D. Submit product data for each component specified. The submittal shall be included as part of the system in which the component is specified.

E. Submit manufacturer's installation instructions under provisions of Section 01 33 00 – Submittal Procedures.

F. Submit samples as requested by the Engineer.

1.04 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of control equipment. Revise diagrams included in Drawings to reflect actual control device connections.

1.05 OPERATION AND MAINTENANCE DATA

A. Include instructions for adjusting and resetting time delay relays, timers, and counters.

B. Include recommended preventive maintenance procedures and materials.

1.06 QUALIFICATIONS

A. Manufacturer – Company specializing in manufacturing the products specified in this Section with a minimum of 10 years' documented experience.

PART 2 – PRODUCTS

2.01 PILOT DEVICES

A. General

1. Pilot devices shall include indicating light, pushbuttons, and selector switches.

2. Heavy-duty, industrial type, construction.

3. Area Classification

a. Non-Classified Area Device Rating – NEMA 13 oil-tight.

b. Wet Area or Exterior Device Rating – NEMA 4 and NEMA 13 oil-tight and watertight.

c. Corrosive Area Device Rating – NEMA 4X, non-metallic.

d. Hazardous Area Device Rating – NEMA 7, explosion-proof.

4. Provide extra-large nameplates in accordance with Section 26 00 10 – Electrical Work, for all door or enclosure front-mounted devices.

5. Controls and relays shall be by one manufacturer wherever possible.

6. Provide enclosure for field mounted devices and individual controls in accordance with Section 26 27 16 – Control Panels and Enclosures.

7. 30-millimeter diameter.

8. Retaining ring and boot type.

B. Pushbuttons (PB) and Selector Switches (SEL SW)

1. Lockout feature as indicated.

2. Color – Red for stop or terminate function; black for all others.

3. Operators

a. Provide “gloved hand” knobs for selector switches.

b. Provide “mushroom head” button on emergency stop pushbuttons.

4. Stackable contact blocks.

5. Devices shall be either momentary, maintained, spring return, push-pull, or other operational types as shown or otherwise specified.

6. Manufacturer NEMA 4 and 13 Oil and Water Tight – General Electric, Square D Type K, or approved equal..

7. Manufacturer NEMA 4X, Non-Metallic - Allen Bradley Type 800H, Square D Type SK, or approved equal.

8. Manufacturer NEMA 7, Explosion-proof - Allen Bradley Type 800H, Crouse-Hinds Type EFS and Type EMP for panel-mounted units or approved equal.

C. Indicating Pilot Lights (IL)

1. Glass or plastic lens.

2. 120-volt LED type.

3. Push-to-test type. When six or more pilot lights are used in control panels, a single lamp test switch can be used in lieu of all lamps being push-to-test.

4. Lens color shall be as follows:

Function	Color
Motor Running	Green
Motor Stopped	Red
Malfunction	Amber
Ready	White or Green

D. Manufacturer:

1. General Electric;

2. Square D;

3. Crouse-Hinds;

4. Allen-Bradley;

5. Or approved equal.

2.02 CONTACT BLOCKS

A. Molded of an amorphous transparent polyamid material with high impact resistance and resistant to carbon tracking.

B. Contacts - Double break silver type rated at 10 amp at 120 VAC continuous.

2.03 CONTROL POWER TRANSFORMER (CPT)

A. Standard industrial control type, VA size as required for the powered load.

B. Dual voltage primary, with 120V ac, single phase secondary. All primary connections fused; size as required for the transformer.

C. Secondary control fuse with capacity for the control circuit indicated.

D. DIN-rail-mounted type in control panels.

E. Manufacturer:

1. Square D;
2. General Electric;
3. Or approved equal.

2.04 FUSE BLOCKS

A. General purpose Class H, K, and R phenolic fuse block for dual-element cartridge fuses.

B. DIN-rail mounted in control panels.

C. Manufacturer:

1. Buchanan;
2. Or approved equal.

2.05 LIMIT SWITCHES (LS)

A. Contacts - Silver-to-silver snap-acting where practicable and in all cases where the motion is slow.

B. Switches - Operated by levers, plungers, or pushrods, depending on the application.

C. Rollers - Provided where excessive wear due to a sliding action would result.

D. Manufacturer:

1. General Electric Class CR215G;
2. Square D Class 9007 Type C;
3. Or approved equal.

2.06 ELAPSED TIME METERS (ETM)

A. Minimum six-digit, non-resettable hour meter, panel mounted.

B. For operation on 120 volts.

C. Manufacturer:

1. General Electric;
2. Or approved equal.

2.07 TIME DELAY RELAYS (TR)

A. Solid-state type with calibrated dial head or dip switch adjustment, encapsulated coil, snap-action switch assembly of number of poles indicated.

B. “On-Delay,” “Off-Delay,” or “On-Off Delay” dual head type as indicated; timing range intervals as shown or specified.

C. Bases shall have captive screws for locking fork solderless connectors, single tier design, with relay retainer clips.

D. Dust-tight construction.

E. Provide auxiliary contacts where indicated.

F. Contacts rated 10 amps resistive at 120 VAC.

G. Manufacturer :

1. Diversified Electronics Series “TD”;

2. Square D Type JCK;

3. Timemark 300 Series;

4. Or approved equal.

2.08 GENERAL PURPOSE CONTROL RELAYS (CR)

A. Units shall be plug-in type.

B. Only for use in manufactured or custom-built control panels.

C. Number of poles and arrangement as shown or specified.

D. Contacts

1. Shall be rated 10 amps at 240 volts AC.

2. Material shall be silver cadmium oxide.

E. Coils shall be rated continuous duty.

F. Socket

1. Supply with relay retainer clip.

2. Terminal connections with captive screw to accept locking fork solderless connectors.

3. Single tier design.

G. Manufacturers:

1. Square D Company Class 8501 Type K relay and Type NR socket;

2. Potter-Brumfield;

3. Or approved equal.

2.09 INDUSTRIAL CONTROL RELAYS (CR)

A. Industrial machine tool type.

B. Use - Shall be used to control equipment with power requirements, such as solenoid valves.

C. Contacts

1. Double break field convertible.

2. Rated 10 amps at 600 volts AC.

3. Rated 5 amps at 250 volts DC

D. Coil shall be encapsulated, continuously rated of the voltage rating indicated on the plans.

E. Number of poles as indicated on Contract Drawings, but not less than four.

F. Holding and Operating Mechanism

1. Electrically held, electrically operated, General Electric Company CR-120A; Square D Company Class 8501, Type X; or approved equal.

2. Mechanically held/electrically held relay with mechanically-held attachment.

3. Time Delay - Pneumatic timer attachment for electrically-held delay; “on delay” or “off delay” as indicated on plans.

2.10 INTRINSICALLY-SAFE BARRIERS

A. Power supply, bistable input amplifier, intrinsically-safe for connections to passive devices located in hazardous areas.

B. Relay Output Stage - LED indicator type.

C. Manufacturer - FM approved:

1. Pepperi & Fuchs WE Series;

2. Square D, Class 8501;

3. Or approved equal.

PART 3 – EXECUTION

3.01 GENERAL

A. Mount all individual controls in a suitable enclosure as specified per Section 26 27 16 – Control Panels and Enclosures.

B. Identify all auxiliary controls per Section 26 00 10 – Electrical Work.

C. General purpose control relays shall be used in manufactured or custom-built control panels. The Contractor shall use control relays as described in Article 2.09 of this Article to control equipment with power requirements, such as solenoid valves.

3.02 CONTROL POWER TRANSFORMER

A. Provide individual control power transformers for each control circuit.

B. Size as required by control circuit.

3.03 FUSE BLOCKS

A. Size as indicated on Drawings or as required.

3.04 LIMIT SWITCHES

A. Limit switches shall be provided where specified and where it is required to convert a mechanical motion into the control of an electric circuit.

3.05 PUSHBUTTONS AND SELECTOR SWITCHES

A. Units shall be back-mounted wherever possible.

END OF SECTION

SECTION 26 27 16
CONTROL PANELS AND ENCLOSURES

PART 1 – GENERAL

1.01 SUMMARY:

A. Section Includes:

1. Hinged cover enclosures.
2. Cabinets.
3. Terminal blocks.
4. Control stations.
5. Accessories.

B. Related Sections:

1. Section 26 00 10 – Electrical Work
2. Section 26 05 29 – Electrical Supports, Anchors, and Fasteners
3. Section 26 09 16 – Auxiliary Controls and Relays
4. Section 26 40 00 – Overcurrent Protective Devices

1.02 REFERENCES

A. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum)

B. NEMA ICS 4 – Terminal Blocks for Industrial Control Equipment and Systems

C. ANSI/NFPA 70 – National Electrical Code

D. UL – Underwriters Laboratories, Inc.

1.03 SUBMITTALS

A. Submit under provisions of Section 26 00 10 – Electrical Work.

B. Submit shop drawings for all control panels. The submitted information shall be detailed specification information proving compliance to these specifications. Submittals shall include, but not be limited to, the following:

1. Enclosure information including size and NEMA classification.

2. Subpanel layout.

3. Wiring diagrams and elementaries.

4. Bill of materials.

5. Internal components (specification information, cut sheets).

6. List of nameplate titles.

7. Dimensions.

C. Shop drawings shall be submitted for all materials used as enclosures.

D. Submit equipment and material samples as requested by the Engineer.

E. Manufacturer's Instructions - Indicate application conditions and limitations of use stipulated by product testing agency as specified in this Section. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.04 DEFINITIONS

A. Power Wiring - Shall mean conductors, conduit, wireway and connections, and related electrical work to supply electrical power to equipment, including electrical power to supply point for equipment control systems.

B. Control Wiring - Shall mean conductors, conduit, wireway, construction and related work to connect or interconnect relays, solenoids, contact devices, signal lights and audible signals, as well as any and all other electrical control devices indicated as related to the control functions.

C. Control Panel (CP) - Is an enclosure used to house logic or power devices such as CPT, starters, contactors, relays, timers, and may also contain pilot devices.

D. Local Control Station (LCS) - Is an enclosure used to house pilot devices only, such as pushbuttons, indicating lights, and selector switches.

1.05 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to authority having jurisdiction, as suitable for purpose specified and shown.

PART 2 – PRODUCTS

2.01 MANUFACTURERS - NEMA 4 EPOXY COATED

A. Hoffman - Model Series EPLP;

B. Appleton - Model ECH/ECHT;

C. Or approved equal.

2.02 MANUFACTURERS - NEMA 4X STAINLESS STEEL

A. Hoffman - Model Series SSLP;

B. Hammond – 1418NA S.S. Series, wall mounted; 1422NA S.S. Series, floor mounted;

C. Or approved equal.

2.03 MANUFACTURERS - NEMA 4X NON-METALLIC

A. Carlon - Model “Himeline" Series HL;

B. Hammond – “PJ” Series;

C. Or approved equal.

2.04 MANUFACTURERS - NEMA 7

A. Killark - Model “Quantum” Series EXB;

B. Appleton - Model EXB;

C. Or approved equal.

2.05 MANUFACTURERS - NEMA 12 SINGLE DOOR

A. Hoffman - Model Series LP;

B. Hammond – 1418 Series;

C. Or approved equal.

2.06 MANUFACTURERS - NEMA 12, TWO-DOOR AND FREE STANDING

A. Hoffman - Model Series ULP and FS;

B. Hammond – 1418 Series;

C. Or approved equal.

2.07 SHEET METAL ENCLOSURE FABRICATION

A. After fabrication and assembly of all sheet metal enclosures, grind all welds smooth, and then thoroughly degrease and clean. Apply at least two coats of rust inhibiting primer or undercoat of the manufacturer's standard quality followed by at least two coats of baked enamel or epoxy finish. For exterior enclosures utilizing an epoxy finish, the enclosure shall have a final overcoat of clear acrylic polyurethane.

1. Finish Color of All Enclosures - ANSI 61 Light Gray.

B. Turn back edges and file all sharp corners smooth.

C. Enclosure Opening

1. Roll lips on all sides.

2. Provide neoprene gasket.

3. Provide drip shield kits for exterior enclosures.

D. Doors

1. Rolled lips on unhinged sides (three sides).

2. Full length piano type hinges.

3. Provide all front or rear panel doors with door holders sized appropriately for the weight of the equipment on the door.

4. NEMA 4X and 12 Door Latches - 1/4-turn handle.

5. Hinged doors over 24 inches high shall have latching device at three points.

6. Provide mechanical interlock between door and panel power disconnect mechanism. The interlock is to prevent the door from opening while the disconnect switch is closed. Provide an unlabeled defeater mechanism to permit qualified personnel access to panel while it is powered.

2.08 ACCESSORIES

A. Manufacturer - Cable Ties

1. Thomas & Betts - Model Nylon TY-WRAPS;

2. Burndy – Ty-Wrap;

3. Or approved equal.

B. Manufacturer - Terminal Blocks

1. Buchanan - Model 0241;

2. Connectron - Model N553;

3. Or approved equal.

C. Manufacturer - Wire Duct

1. Stahlin Brothers - Model XT-Panel Channel;

2. Panduit Corporation - Model Type E-Dark Grey;

3. Or approved equal.

D. Manufacturer - Grounding Terminals

1. Burndy - Model OA4C-AB;

2. Ilsco Corp;

3. Or approved equal.

E. Provide one drawing pocket in the panel, minimum size 10 inches wide by 10 inches high by 1/2 inch deep, panel manufacturer's standard material and finish.

F. Power Disconnect Switch - Built in to flange of enclosure with door interlock. Through-the-door types will not be acceptable.

2.09 ENCLOSURE – HVAC

A. The control panel enclosures shall be provided with heating, ventilating and/or air conditioning equipment as necessary. This equipment shall be sized to maintain a temperature above 40 degrees F and below 100 degrees F to accommodate the VFDs and instrumentation located within the enclosure.

PART 3 – EXECUTION

3.01 ELECTRICAL CONTROLS

A. Shall be in accordance with Section 26 09 16 – Auxiliary Controls and Relays.

3.02 POWER CIRCUIT PROTECTIVE DEVICES

A. Shall be in accordance with Section 26 40 00 – Overcurrent Protective Devices.

3.03 NAMEPLATES

A. Provide nameplates on the exterior of each enclosure identifying the application or function of the enclosed equipment.

B. Nameplates and labels per Section 26 00 10 – Electrical Work.

3.04 EQUIPMENT HOUSING TYPES

A. Enclosure, Control Panel or Device Applications –When no type is shown or specified, provide stainless steel.

1. Exterior Locations - NEMA 4 stainless steel
2. Interior Wet Locations - NEMA 4 stainless steel
3. Corrosive Areas - NEMA 4X stainless steel
4. Hazardous Areas - NEMA 7
5. All Other Areas - NEMA 12 painted

3.05 CONTROL PANEL CONNECTIONS

A. Regardless of who furnishes or installs the various panels, all are connected electrically by the electrical trade unless specifically shown or specified otherwise.

3.06 FINISH REPAIR

A. Repair damage to the factory. Depending on the extent of damage to the factory-finish and/or the closeness of the color match of any field-applied paint, a complete repainting may be ordered by the Owner at their discretion.

3.07 DOOR QUANTITY

A. Provide two doors if panel is larger than 36 inches wide.

3.08 CONTROLS AND ASSOCIATED CIRCUITRY

A. Each control panel shall contain all applicable disconnects, including a single main power disconnect (unless specifically shown otherwise on the drawings); motor circuit disconnect - one for each motor; necessary control pushbuttons; timers; relays; door interlock switches; indicator lights; selector switches; alarms; instruments and associated

circuitry to monitor and control the associated equipment. Main power disconnect operating mechanisms shall be flange mounted not through the door.

3.09 CONTROL PANEL WIRING

A. Wire Type - See Section 26 00 10 – Electrical Work.

B. Wire Duct - Used for wiring between devices that are mounted on the back panel of control panels.

C. Wire Bundling - Where it is not possible to run wire in wire duct, such as wire run from devices located in the back of a panel to devices mounted on the door of a panel, the wire is to be bundled. Wire lacing or twine is not acceptable.

1. Bundles are to be wrapped by a spiral plastic protective sheath. Secure bundles to the panel structure for a stable support with a spacing of no less than every 8 inches.

2. A wire bundle which must cross a hinge shall run along the hinge as far as possible or have a large loop in bundle and be secured at both ends so that the twisting is taken over the longest length of hinge possible. Wire shall not be split off from the bundle along this length.

D. Wiring and Termination Methods - Interior wiring to be point-to-point with no splices. All wiring from and to the control panel to be through terminals located in the panel. Solderless insulated crimp-type locking fork lugs shall be used for terminations to screw-type terminals. Where screw-type terminals are not used, terminals shall be of the tubular clamp type. Install lugs such that no uninsulated wire is visible at the wire entry point, and wire strands are visible but not protruding from the screw connections end. Use solderless connectors or tubular clamp connectors for all connections to terminals and equipment.

E. Shielded Wire - Separate from other wires and equipment with suitable barriers and with terminal blocks for continuous shield grounding to the connecting cables.

F. Separate intrinsically safe wiring from all other wiring with barriers.

G. Furnish panels factory-wired and tested with all equipment and appurtenances mounted thereon.

H. Wire Labeling - Mark wires at both ends with numbers from Engineer-approved elementaries per Section 26 00 10 – Electrical Work.

1. Color coding per Section 26 00 10 – Electrical Work.

I. Panel Wiring - All panel wiring shall be installed by the panel manufacturer.

J. Lamp Test Switch – For panels with more than five indicating lights. Provide a single lamp test switch in lieu of push-to-test type indicating light.

3.10 TERMINAL BLOCKS

A. Arrange terminals in alphabetic and numeric order in columns on removable subplates. Locate columns at least 4 inches from any edge of the subplate and space 6-inch on centers and at least 2 inches from a wiring duct.

B. Provide marked terminals with wire number from Engineer-approved elementaries. Locate terminals with the same wire number adjacent to each other and jumpered.

C. Make a maximum of two connections to each side of a terminal, including jumpers.

D. Provide an additional 20 percent spare terminals with the following as minimum requirements:

1. Power Terminals - Two spares.

2. Control Terminals - Ten spares.

E. At least one position on a terminal block must be reserved for termination of each incoming wire. Locate all such positions on the same side of the column of terminals. A wiring duct to feed the terminals must be sized to include wires for these positions.

F. Connect all ground terminals of power receptacles solidly to the frame of the panel. Provide the panel with one grounding terminal in the control panel. Mount grounding terminals to the frame of the panel or rack.

3.11 WIRING DUCT

A. Size wiring duct at 60 percent fill according to the maximum number of wires at any cross section, including field wiring terminations and spares. Wiring duct must be plastic.

3.12 CONTROL PANEL INSTALLATION

A. Wall mount panel enclosures that are up to 48 inches in height; floor mount larger panel enclosures, unless otherwise noted on drawings.

B. Furnish control panels, where shown, with power disconnect switches which will de-energize the power supply to the panel.

C. Ground Panels - Connect all equipment and circuits in the panels shown or required to be grounded to the grounding conductors.

D. Install panels where shown. Provide conduit entry as required for the installation.

E. Upon completion of installation, the equipment manufacturer's representative shall check panels and make necessary adjustments.

F. Panel manufacturer to mount all equipment shown or specified to be furnished with a panel. Furnish panels as completely assembled units.

G. For all wall-mounted panels, provide a minimum of four brackets designed for wall mounting.

3.13 MOUNTING HEIGHT

A. Mount control panels such that:

1. No disconnect handle is higher than 6 feet to the highest part of handle. Mount all separately enclosed circuit breaker and disconnect switch handles 4 feet 6 inches from floor or other working surface unless otherwise indicated (5 feet to the top of enclosure).

2. Top of wall-mounted enclosures shall not be higher than 5 feet 6 inches.

3. No pilot device is higher than 5 feet.

4. No operator interface device (i.e., graphic display screen, etc.) is higher than 4 feet 6 inches to the centerline of the device.

3.14 ENCLOSURE INSTALLATION METHODS

A. Support - Adequately support all enclosures from walls, structure, or on support panels or plates independently of the conduit system. Provide additional supports for seismic restraint.

B. Support Material - Size fasteners utilizing a safety factor of 5.

C. Mounting Accessories - Section 26 05 29 – Electrical Supports, Anchors, and Fasteners.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 26 40 00
OVERCURRENT PROTECTIVE DEVICES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Circuit breakers below 600 volts.
2. Fuses below 600 volts.
3. Spare fuse cabinet.

B. Related Sections:

1. Section 26 00 10 – Electrical Work
2. Section 26 27 16 – Control Panels and Enclosures
3. Section 26 05 29 – Electrical Supports, Anchors and Fasteners

1.02 REFERENCES

A. NECA (National Electrical Contractors Association) “Standard of Installation”

B. NEMA AB 1 – Molded Case Circuit Breakers

C. ANSI/NFPA 70 – National Electrical Code

D. NEMA FU 1 – Low Voltage Cartridge Fuses

E. UL – Underwriters Laboratories, Inc.

1.03 SUBMITTALS

A. Submit under provisions of Section 26 00 10 – Electrical Work

B. Product Data - Provide catalog sheets showing ratings, trip units, time current curves, dimensions, and enclosure details.

C. Manufacturer’s Installation Instructions - Indicate application conditions and limitations of use stipulated by product testing agency as specified in this Section. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

D. Samples as requested by the Engineer.

1.04 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Circuit Breakers - Conform to requirements of NEMA AB-1 and UL 489.

C. Furnish products listed and classified by UL or other third-party testing firm acceptable to authority having jurisdiction as suitable for purpose specified and indicated.

1.05 EXTRA MATERIALS

A. Provide three of each size and type current limiter.

B. Contractor to provide separate NEMA 12 enclosure and shall provide spare fuses for each type used, as follows:

1. Power distribution fuses above 200 amps - One set.

2. All others - Two sets.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Circuit Breakers

1. Square D;

2. Cutler Hammer;

3. General Electric;

4. Or approved equal.

B. Main Fuses, Unless Otherwise Noted

1. Bussman - Model CPN-RK;

2. Gould-Shawmut - Model A2K;

3. Or approved equal.

C. Motor and Device Fuses, Unless Otherwise Noted

1. Bussman - Model RU5;

2. Gould-Shawmut - Model TRI-ONIC;

3. Or approved equal.

2.02 GENERAL REQUIREMENTS

A. Circuit breakers shall be of the molded case type.

B. Shall consist of the number of poles, ampere rating, and interrupting rating as shown or specified.

C. Molded case circuit breakers shall have overcenter toggle-type mechanism, providing quick-make, quick-break action. Mechanism shall be mechanically trip-free from the handle so the contacts cannot be held closed against short circuit currents.

D. Multiple pole breakers shall be common trip type.

E. On and Off positions shall be clearly marked and color coded.

F. All breakers in panels for switching duty shall be “SWD” or “T” rated, for switching duty.

G. Breakers 250 ampere frame and larger shall have interchangeable trip.

H. All main service breakers shall have 100 percent ampere rating and shall be service entrance rated.

I. Breakers over 100-ampere frame size shall have front adjustable magnetic trip elements to provide instantaneous tripping over a range of 400 to 1000 percent of the continuous ampere trip rating.

J. All breakers shall be of the bolt-on type.

K. Dimensions and Performance - NEMA FU 1, Class as specified or indicated.

L. Voltage - Provide fuses with voltage rating suitable for circuit phase-to-phase voltage.

2.03 CONTACTS

A. Contacts shall be non-welding under rated operating conditions.

B. Silver-to-silver type.

C. Provide with suitable arc interrupting devices.

2.04 TERMINATIONS

A. Circuit breakers shall have lugs that accommodate wire sizes shown on the Contract Drawings, including additional lugs where shown or required.

B. Lugs shall be UL listed for copper conductors only.

C. Breakers shall be UL listed for mechanical-type lugs.

2.05 GROUND FAULT PROTECTION

A. 250-ampere frame circuit breakers or less.

1. Integral with circuit breaker.

2. Push to test.

3. Reset feature.

4. Trip indication.

5. 0.8-second maximum pickup time.

2.06 RATINGS

A. All circuit breakers shall meet or exceed the following unless otherwise noted on the Contract Drawings or in the specifications.

Frame Size Maximum Constant Current - AMPS	NEMA* Interrupting Cap. Symmetrical-AMPS	Poles	Maximum Voltage Rating
100	10,000 @ 120 volts	1	120
100	10,000 @ 240 volts	2,3	240
100	18,000 @ 480/277 volts	1	480
100	18,000	2,3	600
250 Branch	25,000	2,3	600
250 Main	35,000	2,3	600
400 Branch	30,000	2,3	600
400 Main	35,000	2,3	600
1000 Branch	30,000	2,3	600
1000 Main	65,000	2,3	600
1200	100,000	2,3	600
2000	100,000	2,3	600

*Interrupt ratings are at 480 volts unless noted otherwise.

2.07 BREAKER TRIP CHARACTERISTICS

A. All breakers shall be Type A thermal magnetic type unless noted otherwise on the Contract Drawings or specified.

B. Thermal Magnetic Type (Type A)

1. Long time, nonadjustable, thermal overload, trip.

2. Instantaneous, electromagnetic trip.

3. Ambient compensating.

4. “Push-to-trip” test button.

C. Integral Magnetic and Solid State Trip Type (Type B)

1. Provide solid-state logic programmer.

2. Long delay, range adjustable trip.

3. Magnetic pick up, range and time adjustable, trip.

4. Integral power supply.

5. 100 percent equipment rated.

6. Integral ground fault protection where noted on the Contract Drawings or specified.

7. Ground fault system neutral current transformer for each breaker equipped for ground fault.

8. “Push-to-trip” pushbutton.

9. Adjustable rating plug type.

D. Integral Solid State Trip Type (Type C)

1. Solid state logic programmer.

2. Long delay, range and time adjustable, trip.

3. Short delay, range and time adjustable, trip where noted.

4. Instantaneous, range adjustable, trip unless noted otherwise for specific breakers.

5. Ground fault, range and time adjustable, trip where noted.

6. Neutral sensor for each breaker equipped with ground fault on three phase, four wire, enclosed breakers, panels and switchboards.

7. 100 percent equipment rated.

8. Integral power supply.

9. “Push to Trip” button.

10. Sensor ratings 200-1200 ampere.

11. Provide trip targets for overload, short circuit and ground fault for breakers as noted on Contract Documents:

E. Motor Circuit Protectors (Type MCP)

1. Each pole shall provide instantaneous short circuit protection.

2. MCP shall have provisions for adjusting the instantaneous magnetic trip element.

3. All poles shall be constructed to open, close, and trip simultaneously.

4. The MCP mechanism shall be the transient inrush suppressor type appropriate for the protection of energy efficient motors.

2.08 CURRENT LIMITERS

A. Current Limiter - Designed for application with molded case circuit breaker.

B. Coordinate limiter size with trip rating of circuit breaker to prevent nuisance tripping and to achieve interrupting current rating specified for circuit breaker.

C. Provide interlocks to trip circuit breaker and to prevent closing circuit breaker when limiter compartment cover is removed or when one or more limiter is not in place or has operated.

2.09 FUSES

A. Main Service Switches - Class RK (time delay).

B. Motor Load Feeder Switches - Class RK (time delay).

C. Other Feeder Switches - Class RK (time delay).

D. Power Branch Circuits - Class RK (time delay).

E. Motor Branch Circuits - Class RK (time delay).

F. Lighting Branch Circuits - Glass G.

PART 3 – EXECUTION

3.01 GENERAL

A. Circuit breaker trip ratings and fuse sizings shown on the Contract Drawings are maximum for the specific application.

B. Breakers shall be removable from the front of the panel or board without disturbing adjacent units.

C. All breakers and fuses shall be suitably mounted in an enclosure in accordance with Section 26 27 16 – Control Panels and Enclosures and supported in accordance with Section 26 05 29 – Electrical Supports, Anchors and Fasteners.

D. Individual-mounted circuit breakers and fused switches shall be provided with NEMA enclosures and installed at locations shown on Drawings and as required by National Electrical Code (NEC) at approximately 60 inches from floor to top of enclosure.

E. Fuses shall be of the rejection type unless otherwise shown or specified.

F. Install spare fuse enclosure where indicated by Owner.

3.02 HANDLE OPERATORS

A. All enclosures for individually-mounted circuit breakers or fuses shall have enclosure-mounted handle operators, operating through approximately 180-degree arc. Flush mounted circular rotating handle operators are unacceptable.

3.03 DISCONNECTING MEANS - LOCKING

A. For separately-mounted exterior circuit breakers, safety and disconnect switches, provide locking-type handles to be locked in both the On (closed) or Off (open) positions.

3.04 IDENTIFICATION

A. Circuit breakers shall be provided with uniformly designed nameplates to clearly indicate the type, rating, listing/recognition/certification marks, and other information as defined in UL 489 in accordance with Section 26 00 10 – Electrical Work.

3.05 TERMINALS

A. All terminals shall comply with UL 486A and B and CSA 1165 Standards. Torque markings shall be provided and followed per UL 489.

B. Terminals shall be amply sized, including adapters or special lugs to connect the conductor(s) as shown, specified or required.

3.06 RATINGS - FUSES

A. Main distribution fuses shall be sized as shown on the Contract Drawings.

B. Motor and device fuses shall be sized as per the manufacturer's requirements in accordance with the NEC.

3.07 FIELD QUALITY CONTROL

A. Inspect each circuit breaker visually, per NETA ATS-1995.

B. Perform several mechanical On-Off operations on each circuit breaker.

C. Verify circuit continuity on each pole in closed position.

D. Determine that circuit breaker will trip on overcurrent condition, with tripping time to NEMA AB-1 requirements.

E. Include description of testing and results in test report.

3.08 ADJUSTING

A. Adjust trip settings so that circuit breakers coordinate with other overcurrent protective devices in circuit.

B. Adjust trip settings to provide adequate protection from overcurrent and fault currents.

END OF SECTION

SECTION 31 00 01

EARTHWORK

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish all labor, equipment, and materials required to complete all work associated with excavation (including off-site borrow excavation), fill and backfill placement and compaction, testing of soil materials and compaction by an independent Materials Testing Consultant, constructing embankments, dewatering, construction of drainage layers, installing foundation and backfill aggregate, placing filter and separation fabrics, stockpiling topsoil and any excess suitable material, designing, installing, maintaining and removing excavation support systems, disposing of all excess and unsuitable materials, providing erosion and sedimentation control, encasing utility conduits, site grading, preparation of pavement and structure subgrades, and other related and incidental work as required to complete the work shown on the Drawings and as specified herein.

B. All excavations shall be in conformity with the lines, grades, and cross sections shown on the Drawings or established by the Engineer.

C. It is the intent of this Specification that the Contractor conduct the construction activities in such a manner that erosion of disturbed areas and off-site sedimentation be prevented to the maximum extent practicable.

D. Earthwork performed under this Contract shall be done in conformance with these specifications. Items and activities not addressed herein shall be subject to the limitations of the latest editions of the New York State Department of Transportation Standard Specifications. If there is a conflict between this specification and the NYSDOT Standard Specifications, the more conservative of the two shall take precedent.

E. Erosion and Sediment Control shall be performed in accordance with Section 31 25 00 – Erosion and Sedimentation Control and with the latest edition of the New York State Standards and Specifications for Erosion and Sediment Control. If there is a conflict between this specification and the Erosion and Sediment Control Standards, the more conservative of the two shall take precedent.

F. All fill materials (soil, aggregate, topsoil, etc.) imported to the site and onsite materials to be reused as fill, backfill, or embankment shall be subjected to the testing requirements contained in Article 1.03 of this Section. The Contractor shall retain a Materials Testing Consultant who shall perform all testing. The test results shall be used to determine if a material meets the requirements included herein. The Contractor shall furnish all necessary samples for laboratory testing and shall provide assistance and cooperation during field tests. The Contractor shall plan their operations to allow adequate time for laboratory tests and to permit taking of field density tests during compaction.

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G. Any costs for re-testing required as a result of failure to meet compaction requirements shall be borne solely by the Contractor.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Requirements of related work are included in Divisions 02, 31, 32, and 33 of these Specifications.

B. Section 31 05 19 – Geotextiles

C. Section 31 10 00 – Clearing, Grubbing and Site Preparation

D. Section 31 25 00 – Erosion and Sedimentation Control

E. Section 32 11 00 – Surface Restoration

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of the other requirements of the Specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced Specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. New York State Department of Transportation Standard Specifications, latest edition.

2. New York State Department Environmental Conservation, Standards and Specifications for Erosion and Sediment Control

3. New York State Environmental Conservation Law

a. Freshwater Wetlands:

1) No disturbance to wetlands is authorized.

2) Employ measures sufficient to prevent contamination of the freshwater wetland by sediment, fuels, concrete leachate or any other pollutants associated with construction or construction procedures.

b. Protection of Waters:

1) No modifications to the bed or banks of streams are authorized.

2) All instream work, as well as any work that may result in the suspension of sediment, is prohibited during the trout spawning and incubation period commencing October 1 and ending April 30.

3) No turbid water resulting from dewatering operations shall be discharged directly to or allowed to enter drainage swales or storm sewers. Such water shall be pumped to settling tanks and discharged to an upland vegetated area prior to any discharge to drainage swale or storm sewers. All other necessary measures shall be implemented to prevent any visible increase in turbidity or sedimentation downstream of the work site.

4. New York State Industrial Code, Part 23, “Protection in Construction, Demolition, and Excavation Operations.”

5. American Society for Testing and Materials (ASTM):

   a. ASTM C127 – Test for Specific Gravity and Absorption of Coarse Aggregate.

   b. ASTM C136 – Test for Sieve Analysis of Fine and Coarse Aggregates.

   c. ASTM D422 – Particle Size Analysis of Soils.

   d. ASTM D423 – Test for Liquid Limit of Soils.

   e. ASTM D424 – Test for Plastic Limit and Plasticity Index of Soils.

   f. ASTM C535 – Test for Resistance to Degradation of Large Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

   g. ASTM D698 – Standard Method of Test for the Moisture - Density Relations of Soils Using a 5.5 lb. (2.5 kg) Rammer and a 12-inch (305 mm) Drop.

   h. ASTM D1556 – Test for Density of Soil in Place by the Sand-Cone Method.

   i. ASTM D1557 – Test for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10-lbs. (4.5 kg) Rammer and 18-inch (457 mm) Drop.

   j. ASTM D2049 – Test Method for Relative Density of Cohesionless Soils.

   k. ASTM D2167 – Test for Density of Soil in Place by the Rubber-Balloon Method.

   l. ASTM D2216 – Test for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil Aggregate Mixtures.

   m. ASTM D2487 – Test for Classification of Soils for Engineering Purposes.

   n. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

o. ASTM D 6913 – Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

p. ASTM D 6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depth).

q. ASTM D7929 – Standard Test Method for Particle Size Distribution of Fine-Grained Soils Using Hydrometer Analysis

1.04 SUBSURFACE CONDITIONS

A. Information on subsurface conditions is referenced under Division 01, General Requirements.

B. Attention is directed to the possible location of water pipes, sanitary pipes, storm drains, and other utilities located in the area of proposed excavation. In the event excavation activities disrupt service, the Contractor shall perform all repairs at no additional cost to the Owner. The Contractor shall contact Dig Safely New York at phone number 811 or 1-800-962-7962 to request an underground utility location mark-out at least two (2) working days, not including the day the request is called in, but no more than ten (10) working days prior to the beginning of excavation. The Contractor shall also contact and request utility location mark-out from buried utility owners with utilities on the project site that are not participants of Dig Safely New York.

1.05 SUBMITTALS

A. In accordance with the procedures and requirements set forth in Section 01 33 00 – Submittal Procedures, the Contractor shall submit the following:

1. Name and location of all material suppliers.

2. Certificate of compliance with the standards specified herein for each source of each material.

3. List of disposal sites for excess, waste, and unsuitable materials and all required permits for use of those sites.

4. Plans and cross sections of open cut excavations showing side slopes and limits of the excavation at grade.

5. Procedures for dewatering proposed by the Contractor shall be submitted to the Engineer for review and approval prior to any earthwork operations.

6. Samples of synthetic filter fabric and reinforced plastic membrane with manufacturer's certificates or catalog cuts stating the mechanical and physical properties. Samples shall be at least one (1) foot wide and four (4) feet long taken across the roll with the warp direction appropriately marked.

7. Construction drawings and structural calculations for any types of excavation support required. Drawings and calculations shall be sealed by a currently registered Professional Engineer in New York State.

8. Monitoring plan and pre-construction condition inspection and documentation of all adjacent structures, utilities, and roadways near proposed installation of excavation support systems and near areas where dewatering is required to facilitate construction.

9. A representative sample of the on-site or off-site source of each class of fill material weighing approximately 50 lbs. The sample shall be delivered to a location designated by the Engineer.

10. The Contractor shall be required to submit plans of open cut excavation for review by the Engineer before approval is given to proceed.

11. Submit excavation support installer qualifications with installation history.

12. Drawings and calculations on proposed excavation support systems sealed by a Professional Engineer currently registered in New York State in which the project is located.

13. Contractor shall also submit a monitoring plan developed by the excavation support design engineer.

14. Earthwork contractor qualifications.

15. All required permits and a list of disposal sites for excess and unsuitable materials within thirty (30) consecutive days after Notice to Proceed. If the disposal site is located on private property, the submittal shall also include written permission from the owner of record.

16. Except where borrow is to be obtained from a commercial source, a borrow source development, use, and reclamation plan jointly developed by the Contractor and the property owner prior to engaging in any land disturbing activity on the proposed source (other than material sampling that may be necessary). The Contractor's plan shall address the following

    a. Drainage: The source shall be graded to drain such that no water will collect or stand and a functioning drainage system shall be provided. If drainage is not practical, and the source is to serve as a pond, the minimum average depth below the water table shall be 4 feet or the source graded so as to create wetlands as appropriate, or as agreed to with the property owner

    b. Slopes: The source shall be dressed and shaped in a continuous manner to contours which are comparable to and blend in with the adjacent topography, but in no case will slopes steeper than 3:1 be permitted.

c. Erosion Control: Except where borrow is to be obtained from a commercial source, the Contractor and the property owner shall jointly submit a Borrow Source Development, Use, and Erosion Control Plan to the appropriate State or Local permitting authority for approval and provide evidence of such to the Engineer for their approval prior to engaging in any land disturbing activity on the proposed source other than material sampling that may be necessary.

1.06 PRODUCT HANDLING

A. Soil and rock material shall be excavated, transported, placed, and stored in a manner so as to prevent contamination, segregation and excessive wetting. Materials which have become contaminated or segregated will not be permitted in the performance of the work and shall be removed from the site.

PART 2 – PRODUCTS

2.01 FILL MATERIALS

A. The contractor shall be responsible for providing fill materials meeting the gradation requirements included herein.

B. All fill materials shall be free of organic material, environmental contaminants, snow, ice, frozen soil, or other unsuitable material.

C. Bedding material installed above and below the water table shall meet the requirements of the New York State Department of Transportation Standard Specifications, latest edition.

D. Below-grade walls shall be backfilled with Select Fill.

E. When the excavated material from required excavations meets the requirements of Select Fill or Common Fill but is replaced with off-site borrow material for the Contractor's convenience, the costs associated with such work and material shall be borne by the Contractor.

F. Where excavated material does not meet the requirements for Select Fill or Common Fill, the Contractor shall furnish off-site borrow material meeting the specified requirements herein. Determination of whether the borrow material will be paid for as an extra cost will be made based on the contract documents.

G. Contractor may stockpile excavated material to be used as Select Fill, Common Fill, Drainage Fill or Topsoil on site in areas designated in the Contract Documents. Soil materials may be stockpiled as necessary to sort, segregate, test, and transfer the materials. Excess material and materials considered unsuitable for reuse by the Engineer shall be removed from the site for off-site disposal. No stockpiling of excavated

material is allowed in a manner or location that would permit erosion and its subsequent sedimentation in wetlands or other natural areas.

2.02 GRANULAR FILL

A. Granular Fill shall be used where shown on the Contract Drawings.

B. Granular Fill shall not include particles or lumps larger than 3 inches.

C. Granular Fill used as backfill against walls shall not contain any rock larger than 1½ - inches.

D. Granular Fill shall be free of organic material, environmental contaminants, snow, ice, frozen soil, or other unsuitable material.

E. Granular Fill shall be placed in max 12-inch-thick lifts.

F. Granular Fill shall be compacted to not less than 95 percent of the maximum dry density obtainable by ASTM Test Method D 1557 and does not contain unsuitable material.

G. Granular Fill shall be compacted at a moisture content within +/- 2 percent of the optimum moisture content of the fill material.

H. All materials used as Granular Fill are subject to approval by the Engineer.

I. Granular Fill shall meet the following gradation requirements:

U.S. Standard Sieve Size	Percent Finer by Weight
2 in.	100
1 in.	80 – 100
3/8 in.	70 – 100
No. 10	50 – 100
No. 30	30 – 85
No. 60	15 – 65
No. 200	5 – 15

2.03 CRUSHED STONE

A. See Section 31 05 16 – Aggregate Materials.

2.04 TOPSOIL

A. Topsoil shall be friable and loamy (loam, sandy loam, silt loam, sandy clay loam, clay loam). It shall be free of debris, trash, stumps, rocks, roots, and noxious weeds, and shall give evidence of being able to support health vegetation. It shall contain no substance potentially toxic to plant growth. All topsoil shall be tested by a recognized laboratory for the following criteria: organic matter content shall not be less than 1.5%

by weight. pH range shall be from 6.0 -7.5. If pH is less than 6.0, lime shall be added in accordance with test results or in accordance with the recommendations of the vegetative establishment practice being used. Soluble salts shall not exceed 500 ppm. If additional topsoil is needed, it must meet the standards stated above.

2.05 GEOTEXTILES

A. The Contractor shall provide geotextiles as indicated on the Contract Drawings and specified herein. The materials and placement shall be as indicated under Section 31 05 19 – Geotextiles.

PART 3 – EXECUTION

3.01 STRIPPING OF TOPSOIL

A. In all areas to be excavated, filled, or paved, the topsoil shall be stripped as indicated in Section 31 10 00 – Clearing, Grubbing and Site Preparation.

B. Topsoil may be stockpiled for subsequent reuse on site at locations shown on the Contract Drawings or designated by the Owner or Engineer. Topsoil shall be kept separated from other excavated materials and shall be piled free of roots and other undesirable materials. Topsoil shall not be stored in areas where it will interfere with surface drainage or with the conservation of trees, shrubs, and other vegetation to remain. No stockpile shall be placed within 50-feet of a pond, stream, wetland, or stormwater inlet.

3.02 EXCAVATION

A. All material excavated, regardless of its nature or composition, shall be classified as UNCLASSIFIED EXCAVATION. Excavation shall include the removal of all soil, rock, weathered rock, rocks of all types, boulders, conduits, pipe, all other obstacles encountered, and all other obstacles shown to be removed within the limits of excavation shown on the Contract Drawings or specified herein. The cost of excavation shall be included in the Lump Sum Bid Price. Additional payment may be made for excavation of rock or large boulders (with a volume greater than one half (1/2) cubic yard) with approval by the Engineer.

B. All suitable material removed in the excavation shall be used as far as practicable in the formation of embankments, subgrades, and shoulders, and at such other places as may be indicated on the Drawings or indicated by the Engineer. No excavation shall be wasted except as may be permitted by the Engineer. Refer to the drawings for specific location and placement of suitable excavated materials in the formation of embankments, backfill, and structural and roadway foundations. THE ENGINEER AND/OR MATERIALS TESTING CONSULTANT WILL DESIGNATE MATERIALS THAT ARE UNSUITABLE. The Contractor shall furnish off-site disposal areas for the unsuitable material. Where suitable materials containing excessive moisture are

encountered above grade in cuts, the Contractor shall construct above grade ditch drains prior to the excavation of the cut material when in the opinion of the Engineer and/or materials testing consultant such measures are necessary to provide proper construction.

C. All excavations shall be made in the dry and in such a manner and to such widths as will give ample room for properly constructing and inspecting the structures and/or piping they are to contain and for such excavation support, pumping and drainage as may be required. Excavation shall be made in accordance with the grades and details shown on the Drawings and as specified herein.

D. Excavation slopes shall be flat enough to avoid slides that will cause disturbance of the subgrade or damage of adjacent areas. Excavation requirements and slopes shall be as indicated in the Drawings.

E. The Contractor shall intercept and collect surface runoff both at the top and bottom of cut slopes. The intersection of slopes with natural ground surfaces, including the beginning and ending of cut slopes, shall be uniformly rounded as shown on the Drawings or as may be indicated by the Engineer. Concurrent with the excavation of cuts the Contractor shall construct intercepting berm ditches or earth berms along and on top of the cut slopes at locations shown on the Drawings or designated by the Engineer. All slopes shall be finished to reasonably uniform surfaces acceptable for seeding and mulching operations. No rock or boulders shall be left in place which protrude more than 1 foot within the typical section cut slope lines, and all rock cuts shall be cleaned of loose and overhanging material. All protruding roots and other objectionable vegetation shall be removed from slopes.

F. It is the intent of these Specifications that all structures shall bear on an aggregate base, crushed stone or screened gravel bedding placed to the thickness shown on the Drawings, specified in these Specifications, or not less than 6-inches.

G. The bottom of all excavations for structures and pipes shall be examined by the Engineer and/or materials testing consultant for bearing value and the presence of unsuitable material. If, in the opinion of the Engineer and/or materials testing consultant, additional excavation is required due to the low bearing value of the subgrade material, or if the in place soils are soft, yielding, pumping or wet, the Contractor shall remove such material to the required width and depth and replace it with thoroughly compacted select fill, and/or crushed stone or screened gravel as indicated by the Engineer. Payment for such additional work ordered by the Engineer shall be made in accordance with the General Conditions and Division 01. No payment will be made for subgrade disturbance caused by inadequate dewatering or improper construction methods.

H. All cuts shall be brought to the grade and cross section shown on the Drawings, or established by the Engineer, prior to final inspection and acceptance by the Engineer.

I. Slides and over-breaks which occur due to negligence, carelessness or improper construction techniques on the part of the Contractor shall be removed and disposed of by the Contractor as indicated by the Engineer at no additional cost to the Owner. If grading operations are suspended for any reason whatsoever, partially completed cut and fill slopes shall be brought to the required slope and the work of seeding and mulching or other required erosion and sedimentation control operations shall be performed.

J. Where the excavation exposes sludge, sludge contaminated soil or other odorous materials, the Contractor shall cover such material at the end of each workday with a minimum of 6 inches and a maximum of 24-inches of Common fill. The work shall be an odor abatement measure and the material shall be placed to the depth deemed satisfactory by the Engineer for this purpose.

3.03 EXCAVATION SUPPORT

A. The Contractor shall furnish, place, and maintain such excavation support which may be required to provide safe working conditions and support sides of excavation or to protect structures, pipes, and utilities from possible. The Contractor shall be exclusively responsible for maintaining safe working conditions and structure integrity without overstressing or damaging existing structures, pipes, and utilities resulting from the Contractor temporarily placing, moving, or removing loads on or adjacent to existing structures, pipes, and utilities. If the Engineer is of the opinion that at any point sufficient or proper supports have not been provided, the Engineer may order additional supports put in at the expense of the Contractor. The Contractor shall be responsible for the adequacy of all supports used and for all damage resulting from failure of support system or from placing, maintaining and removing the support system.

B. The selection of and design of any proposed excavation support systems is exclusively the responsibility of the Contractor. Contractor shall submit drawings and calculations to the Engineer on the proposed systems sealed by a Professional Engineer currently registered in the in the State of New York.

C. The excavation support system shall be installed by a specialized contactor with a minimum of five (5) years' experience installing the type of excavation support system proposed.

D. The Contractor shall exercise caution in the installation and removal of supports to ensure no excessive or unusual loadings or vibrations are transmitted to any new or existing structure. The Contractor shall promptly repair at their expense any and all damage that can be reasonably attributed to installation or removal of excavation support system.

E. Contractor shall monitor movement and vibration in the excavation support systems as well as movement and vibration at adjacent structures, utilities and roadways near excavation supports. Contractor shall submit a monitoring plan developed by the

excavation support design engineer. All pre-construction condition assessment and documentation of adjacent structures on-site and off-site shall be performed by the Contractor. If any sign of distress such as cracking or movement occurs in any adjacent structure, utility or roadway during installation of supports, subsequent excavation, service period of supports, subsequent backfill and construction, or removal of supports, Engineer shall be notified immediately. The Contractor shall be exclusively responsible for repair of any damage to any roadway, structure, utility, pipes, etc. both on-site and off-site, as a result of their operations.

F. All excavation supports shall be removed upon completion of the work except as indicated herein. The Engineer may permit supports to be left in place at the request and expense of the Contractor. The Engineer may order certain supports left permanently in place in addition to that required by the Contract. The cost of the materials so ordered left in place, less a reasonable amount for the eliminated expense of the removal work omitted, will be paid as an extra by a Change Order in accordance with the General Conditions and Division 01. Vibrations of new and existing structures shall be considered when the Contractor decides whether to remove excavation supports or leave them in place.

G. Any excavation supports left in place shall be cut off at least five (5) feet below the finished ground surface or as directed by the Engineer.

3.04 PROTECTION OF SUBGRADE

A. To minimize the disturbance of bearing materials and provide a firm foundation, the Contractor shall comply with the following requirements:

1. Use of heavy rubber tired construction equipment shall not be permitted on the final subgrade unless it can be demonstrated that drawdown of groundwater throughout the entire area of the structure is at least 3 feet below the bottom of the excavation (subgrade). Even then, the use of such equipment shall be prohibited should subgrade disturbance result from concentrated wheel loads.

2. Subgrade soils disturbed through the operations of the Contractor shall be excavated and replaced with compacted select fill or crushed stone at the Contractor's expense as indicated by the Engineer.

3. The Contractor shall provide positive protection against penetration of frost into materials below the bearing level during work in winter months. This protection can consist of a temporary blanket of straw or salt hay covered with a plastic membrane or other acceptable means.

3.05 PROOF-ROLLING

A. The subgrade of all structures and all areas that will support pavements or select fill shall be proof-rolled. After stripping of topsoil, excavation to subgrade and prior to placement of fills, the exposed subgrade shall be carefully inspected by probing and testing as

needed. Any topsoil or other organic material still in place, frozen, wet, soft, or loose soil, and other undesirable materials shall be removed. The exposed subgrade shall be proof-rolled with a heavily loaded tandem-wheeled dump truck to check for pockets of soft material hidden beneath a thin crust of better soil. Any unsuitable materials thus exposed shall be removed and replaced with an approved compacted material, as directed by the Materials Consultant.

3.06 FILL OR EMBANKMENTS

A. Contractor shall perform the construction of fill or embankments in such a manner that cut and fill slopes will be completed to final slopes and grade in a continuous operation. The operation of removing excavation material from any cut and the placement of embankment in any fill shall be a continuous operation to completion unless otherwise permitted by the Engineer.

B. Subgrades upon which fill or embankments are to be constructed shall be stripped of topsoil, organic material, rubbish and other extraneous materials. After stripping and prior to placing fill or embankment material, the Contractor shall compact the top 12-inches of in place soil as specified under Paragraph 3.08, COMPACTION.

C. Any soft or unsuitable materials revealed before or during placement fill or embankment placement shall be removed as indicated by the Engineer and/or materials testing consultant and replaced with select fill and compacted as required.

D. Fill subgrades on which fill or embankment is to be placed, shall be scarified or stepped in a manner which will permit bonding of the embankment with the existing surface. The fill or embankment soils shall be as specified under Part 2 – Products of this Section, and shall be deposited and spread in successive, uniform, approximately horizontal layers. The loose thickness of each lift shall not exceed the thickness for each fill type noted in Paragraph 3.08, COMPACTION.

E. Hauling shall be distributed over the full width of the embankment, and in no case will deep ruts be allowed to form during the construction of the embankment. Fill or embankment subgrades shall be properly drained at all times and kept free of flowing or ponding water, snow, ice and frozen soils. Saturated soils, snow, ice, or frozen soils shall be removed as recommended by the Engineer.

F. The embankment or fill material in the layers shall be of the proper moisture content before rolling to obtain the prescribed compaction. Moisture conditions and manipulation of the fill or embankment material, when necessary, shall be performed to maintain a uniform moisture content throughout the layer. Should the material be too wet or too dry to permit proper compaction, earthwork operations shall be delayed until the material is adequately moisture conditioned. Samples of all fill or embankment materials for testing, both before and after placement and compaction, will be taken at frequent intervals. From these tests, corrections, adjustments, and modifications of methods, materials, and moisture content will be made to construct the embankment.

G. Where fill or embankments materials are to be placed and compacted on sloped subgrades steeper than 4:1 shall be benched. Benches shall be at least 6-feet wide.

I. When rock and other embankment material are excavated at approximately the same time, the rock shall be incorporated into the outer portions of the embankments and the other material which meets the requirements for select fill shall be incorporated into the formation of the embankments. Stones or fragmentary rock larger than 4inches in their greatest dimension will not be allowed within the top 6inches of the final grade. Stones, fragmentary rock, or boulders larger than 12inches in their greatest dimension will not be allowed in any portions of embankments and shall be disposed of by the Contractor as indicated by the Engineer. When rock fragments or stone are used in embankments, the material shall be brought up in layers as specified or directed and every effort shall be exerted to fill the voids with finer material to form a dense, compact mass which meets the densities specified for embankment compaction.

3.07 BACKFILLING

A. All structures and pipes shall be backfilled with the type of materials shown on the Drawings and specified herein. Fill placed as structure or utility backfill shall be deposited in successive, uniform, approximately horizontal lifts. The thickness of each lift shall not exceed the requirements of Paragraph 3.08, COMPACTION.

B. Each lift of fill placed backfill shall be thoroughly compacted to the density specified for each type of fill included in Paragraph 3.08, COMPACTION.

C. Where excavation support is used, the Contractor shall take all reasonable measures to prevent loss of support beneath and adjacent to pipes and existing structures when supports are removed. If significant volumes of soil cannot be prevented from clinging to the extracted supports, the voids shall be continuously backfilled as rapidly as possible. The Contractor shall thereafter limit the depth below subgrade that supports will be installed in similar soil conditions or employ other appropriate means to prevent loss of support.

D. Backfill against concrete or masonry structure shall not be performed until the Work has been reviewed and backfilling permitted. Backfill against walls shall also be deferred until the structural slab for floors above the top fill line have been placed and attained design strength or earlier at the discretion of the Engineer. Partial backfilling against adequately braced wall may be considered by the Engineer on an individual situation basis. Where walls are to be waterproofed, all Work shall be completed and membrane materials dried or cured according to the manufacturer’s instructions before backfilling.

E. Backfill against tanks and other structures which are to retain liquids shall not be performed until leakage tests are completed and accepted by the Engineer in accordance with the Section entitled “Water Tightness Testing”.

3.08 COMPACTION

A. The Contractor shall compact embankments, backfill, crushed stone, aggregate base, and in place subgrade in accordance with the requirements of this Section. The densities specified herein refer to percentages of maximum density as determined by the noted test methods. Compaction of materials on the project shall be in accordance with the following schedule:

	Density % Standard Proctor (D 698)	Density % Mod. Proctor (D 1557)	Max. Lift Thickness as Compacted Inches
Embankments Beneath Structures, Roadways, and Sidewalks*	98	95	8
Common Fill Areas	95	95	8
Backfill Around Structures	95	95	8
Backfill in Pipe Trenches	95	95	8
Crushed Stone Beneath Structures	**	**	12
Select Sand	98	92	8
Subbase Course Beneath Structures, Roadways, and Sidewalks	**	**	8
Crushed Stone Backfill	**	**	12
Crushed Stone Pipe Bedding	**	**	12
In Place Subgrade Beneath Structures, Roadways, and Sidewalks	98	92	Top 12-inches

* Embankments beneath structures shall be considered to include a zone 10 feet out from the foundation of the structure extending down to the natural ground on a 45° slope.
** The aggregate shall be compacted to a degree acceptable to the Engineer by use of a vibratory compactor and/or crawler tractor.

B. Compaction Near Existing Structures

1. Vibratory equipment shall not be used with 25 feet of any existing structure.

2. Within 25 feet of any existing structure, non-vibratory compaction equipment such as a drum roller with a maximum weight of 4 tons should be used. Within 5 feet of any existing structure, a walk behind vibratory sled or roller shall be used.

C. Field density tests will be made by the Materials Testing Consultant to determine if the specified densities have been achieved, and these tests shall be the basis for accepting or rejecting the compaction. In-place density tests will be performed in accordance with ASTM D 1556, ASTM D 1557, or ASTM D 6938. The Engineer, in conjunction with the

Materials Testing Consultant, will be the judge as to which test method will be the most appropriate. Failure to achieve the specified densities shall require the Contractor to recompact the material or remove it as required. The Contractor shall, if necessary, increase the compactive effort by increasing the number of passes, using heavier or more suitable compaction equipment, or by reducing the thickness of the layers. The Contractor shall adjust the moisture contents of the soils to bring them within the optimum range by drying them or adding water as required.

D. Testing will be performed as frequently as deemed necessary by the Engineer and/or Materials Testing Consultant. As a minimum, one in place density test shall be performed for each 1000 cubic yards of embankment placed and 500 cubic yards of backfill placed or one test performed each day for either or as directed by the Engineer or recommended by Material Testing Consultant.

3.09 VIBRATION MONITORING

A. Vibration monitoring shall be performed at nearby structures when compaction work is ongoing. A single monitoring point using vibration monitoring equipment capable of detecting velocities of 0.1 inch/second or less and survey measurements shall be used for vibration monitoring at each of the nearest structures. An elevation measurement on nearby structures shall be taken before compaction work starts, and then at least twice a day during the work with one reading taken at the conclusion of the day's operations. Elevation measurements shall be recorded to an accuracy of 0.005 foot. If at any time the Contractor detects settlement or heave of 0.005-feet or more, or vibration levels of 1.0 inch/second or more, the vibratory compaction shall be stopped immediately, and the Engineer notified.

3.10 REMOVAL OF EXCESS AND UNSUITABLE MATERIALS

A. The Contractor shall remove and dispose of off-site all excess and unsuitable materials. Within thirty (30) consecutive days after Notice to Proceed, the Contractor shall submit to the Engineer for review all required permits and a list of disposal sites for the unsuitable materials. If the disposal site is located on private property, the submittal shall also include written permission from the owner of record.

B. All excess and unsuitable materials shall be disposed of in locations and under conditions that comply with federal, state, and local laws and regulations.

C. The Contractor shall obtain an off-site disposal area prior to beginning demolition or excavation operations.

D. All excess and unsuitable materials shall be hauled in trucks of sufficient capacity and tight construction to prevent spillage. Trucks shall be covered to prevent the propagation of dust.

E. The Contractor is responsible for procuring and providing all labor and materials for testing and sampling excess and unsuitable materials as required by their applicable disposal site.

F. When all excess and unsuitable material disposal operations are completed, the Contractor shall leave the disposal sites in a condition acceptable to the Owner and Owner(s) of the disposal site(s).

3.11 BORROW EXCAVATION

A. Description

1. The work covered by this section consists of the excavation of approved material from borrow sources and the hauling and utilization of such material as required on the Drawings or directed by the Engineer. It shall also include the removing, stockpiling, and replacement of topsoil on the borrow source; the satisfactory disposition of material from the borrow source which is not suitable for use; and the satisfactory restoration of the borrow source and haul roads to an acceptable condition upon completion of the work.

2. Borrow excavation shall not be used before all available suitable unclassified excavation has been used for backfilling and incorporated into the embankments.

B. Coordination with Seeding Operations

1. The Contractor shall coordinate the work covered by this section with the construction of embankments and area fill so the requirements of Section 32 11 00 – Surface Restoration are met.

C. Borrow Materials

1. All material shall meet the requirements of Section 2 for Select Fill or shall meet the requirements of Common Fill and classify as SM or coarser according to ASTM D 2487.

D. Construction Methods

1. General

a. The surface of the borrow area shall be thoroughly cleared and grubbed and cleaned of all unsuitable material including all organics, topsoil, etc., before beginning the excavation. Disposal of material resulting from clearing and grubbing shall be in accordance with Section 31 10 00 – Clearing, Grubbing, and Site Preparation.

b. Each borrow operation shall not be allowed to accumulate exposed, erodible slope area in excess of 1 acre at any one given time without the Contractor's

beginning permanent seeding and mulching of the borrow source or other erosion control measures as may be approved by the Engineer.

c. The topsoil shall be removed and stockpiled at locations that will not interfere with the borrow operations and that meet the approval of the Engineer. Temporary erosion control measures shall be installed as necessary to prevent the erosion of the stockpile material. Once all borrow material has been removed from the source or portion thereof, the stockpiled topsoil shall be spread uniformly over the source.

d. Where it is necessary to haul borrow material over existing roads, the Contractor shall use all necessary precautions to prevent damage to the existing roads. The Contractor shall also conduct hauling operations in such a manner as to not interfere with the normal flow of traffic and shall always keep the traffic lanes free from spillage.

2. Owner Furnished Sources

a. Where borrow sources are furnished by the Owner the location of such sources will be as designated on the Drawings or as directed by the Engineer.

b. The Owner will furnish the necessary haul road right-of-way at locations designated by the Engineer. All haul roads required shall be built, maintained, and when directed by the Engineer, obliterated, at no cost to the Owner. Where the haul road is to be reclaimed for cultivation the Contractor shall plow or scarify the area to a minimum depth of 8 inches, or to the depth requested by the property owner.

c. The borrow sources shall be left in a neat and presentable condition after use. All slopes shall be smoothed, rounded, and constructed not steeper than 3:1. Where the source is to be reclaimed for cultivation the source shall be plowed or scarified to a minimum depth of 8 inches, disc harrowed, and terraces constructed. The source shall be graded to drain such that no water will collect or stand, and a functioning drainage system shall be provided.

d. All sources shall be seeded and mulched in accordance with Section 32 11 00 – Surface Restoration.

3. Contractor Furnished Sources

a. Prior to the approval of any off-site borrow source(s) developed for use on this project, the Contractor shall obtain certification from the State Historic Preservation Officer of the State Department of Cultural Resources certifying that the removal of the borrow material from the borrow source(s) will have no effect on any known district, site building, structure, or object that is included or eligible for inclusion in the National Register of Historic Places. A

copy of this certification shall be furnished to the Engineer prior to performing any work on the proposed borrow source.

b. The approval of borrow sources furnished by the Contractor shall be subject to the following conditions:

1) The Contractor shall be responsible for acquiring the right to take the material and any rights of access that may be necessary; for locating and developing the source; and any clearing and grubbing and drainage ditches necessary.

a) Such right shall be in writing and shall include an agreement with the Owner that the borrow source may be dressed, shaped, seeded, mulched, and drained as required by these Specifications after all borrow has been removed.

2) The Contractor and the property owner shall jointly submit a borrow source development, use, and reclamation plan to the Engineer, as described in Paragraph 1.05, for approval prior to engaging in any land disturbing activity on the proposed source other than material sampling that may be necessary.

4. Maintenance

a. During construction and until final acceptance the Contractor shall use any methods approved by the Engineer which are necessary to maintain the work covered by this Section so that the work will not contribute to excessive soil erosion.

END OF SECTION

SECTION 31 05 16
AGGREGATE MATERIALS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish all labor, equipment and materials required to complete all work associated with the installation of aggregate material beneath foundations, as backfill and as roadway subgrades and other related and incidental work as required to complete the work shown on the Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 00 01 – Earthwork

B. Section 31 25 00 – Erosion and Sedimentation Control

C. Section 32 10 00 – Paving and Surfacing

D. Section 32 11 00 – Surace Restoration

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the Specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. New York State Department of Transportation Standard Specifications

2. ASTM C 127 – Test for Specific Gravity and Absorption of Coarse Aggregate.

3. ASTM C 136 – Test for Sieve Analysis of Fine and Coarse Aggregates.

4. ASTM C 535 – Test for Resistance to Degradation of Large Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures.

1. Materials gradation and certification.

2. ASTM C127, ASTM C136, and ASTM C535 test results

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1.05 DEFINITIONS

A. Unsuitable material: vegetation, muck, coal, sludge, refuse, construction debris, plastic, concrete, bricks, rubble, hazardous waste as defined by 40 CFR 261.3, soft unstable materials, mud, frozen material, organic material including peat, ash, and topsoil, and other deleterious matter designated by the Engineer. Contaminated materials may be considered unsuitable at the discretion of the Engineer.

PART 2 – PRODUCTS

2.01 CRUSHED STONE

A. Crushed stone shall meet the gradation requirements of No. 57 stone and shall consist of durable crushed rock or durable crushed gravel stone and shall be free from ice and snow, roots, sod, rubbish and other deleterious or organic matter or material:

U.S. Standard Sieve Size	Percent Finer by Weight
1 ½" in.	100
1 in.	95-100
1/2 in.	25-60
No. 4	0-10
No. 8	0-5

PART 3 – EXECUTION

3.01 CRUSHED STONE AND LIGHTWEIGHT FILL

A. Contractor shall install crushed stone and screened gravel in accordance with the NYSDOT Standard Specifications and as indicated in the Contract Documents.

1. Unless otherwise stated herein or shown on the Drawings, all mat foundations (bottom slabs) for the proposed structures shall have a blanket of No. 67 stone 6-inches thick maximum. The blanket shall extend a minimum of 12 inches beyond the extremities of the mat.

2. For subgrade preparation at structures and structural fill, the foundation material shall be specified on Drawings; otherwise, crushed stone or screened gravel shall be used.

3. For underdrains, pipe bedding, and drainage layers beneath structures, the coarse aggregate shall meet the requirements of 703-2 and 703-3 as defined by NYSDOT Standard Specifications.

3.02 STOCKPILING

A. Stockpile materials on site within the site limits at locations indicated designated by Engineer.

B. Stockpile differing materials separately to prevent mixing.

C. Direct surface water away from stockpile site so as to prevent erosion or deterioration of materials.

D. Stockpile Cleanup: Remove stockpile, leave area in a clean and neat condition. Grade site surface to prevent free standing surface water.

3.03 COMPACTION

A. Refer to Section 31 00 01 – Earthwork for compaction requirements related to crushed stone, sand-gravel and crushed stone.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 31 05 19

GEOTEXTILES

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install all Geotextiles, including all necessary and incidental items, as detailed or required for the Contractor to complete the installation in accordance with the Drawings and these Specifications.

B. For the location of each type of Geotextile see the Drawings.

1.02 REFERENCES

A. ASTM Standards

1. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles

2. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles

3. ASTM D5261 - Standard Test Method for Measuring Mass per Unit Area of Geotextiles

4. ASTM D6241 - Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe

B. AASHTO Standards

1. AASHTO M 288-06 (2011) Geotextile Specification for Highway Applications

1.03 SUBMITTALS

A. Prior to shipping to the site, the Contractor shall submit to the Engineer two copies of a mill certificate or affidavit signed by a legally authorized official of the Manufacturer for each type of Geotextile. The Supplier shall also submit three Geotextile samples of each product, 1 yard square each, seamed and unseamed as appropriate, with the mill certificate for each Geotextile type supplied. The mill certificate or affidavit shall attest that the Geotextile meets the chemical, physical and manufacturing requirements stated in the specifications. The samples shall be labeled with the manufacturer's lot number, machine direction, date of sampling, project number, specifications, manufacturer and product name.

B. The Engineer shall be furnished copies of the delivery tickets or other acceptable receipts as evidence for materials received that will be incorporated into construction.

PART 2 – MATERIALS

2.01 MATERIALS

A. Filter Geotextile shall be a minimum 6-ounce per square yard (nominal) nonwoven needle punched synthetic fabric consisting of staple or continuous filament polyester or polypropylene manufactured in a manner accepted by the Engineer and the Owner. The Geotextiles shall be inert and unaffected by long-term exposure to chemicals or liquids with a pH range from 3 to 10. The Geotextiles shall have a minimum threshold water head of 0.25-inches in the "as received" condition.

1. Filter Geotextile shall have a Survivability Class of Class 1 or 2 in accordance with AASHTO M288, unless otherwise specified herein.

B. Type I Separator Geotextile shall be a minimum 8-ounce per square yard (nominal) nonwoven needle punched synthetic fabric consisting of staple or continuous filament polyester or polypropylene manufactured in a manner accepted by the Engineer and the Owner. The Geotextiles shall be inert and unaffected by long term exposure to chemicals or liquids with a pH range from 3 to 10.

1. Type I Separator Geotextile shall have a Survivability Class of Class 1 or 2 in accordance with AASHTO M288, unless otherwise specified herein.

C. Type II Separator Geotextile shall be a woven slit film or monofilament synthetic fabric consisting of polyester or polypropylene in a manner approved by the Engineer. Geotextile shall be treated to resist degradation due to exposure to ultraviolet light.

1. Type II Separator Geotextile shall have a Survivability Class of Class 1 in accordance with AASHTO M288, unless otherwise specified herein.

D. All Geotextiles shall conform to the properties listed using the test methods listed in Table 1. The Contractor shall be responsible for timely submittals of all confirmation test data for Geotextiles.

PART 3 – EXECUTION

3.01 SHIPPING, HANDLING AND STORAGE

A. During all periods of shipment and storage, all Geotextiles shall be protected from direct sunlight, temperature greater than 140°F water, mud, dirt, dust, and debris.

B. To the extent possible, the Geotextile shall be maintained wrapped in heavy-duty protective covering until use. Geotextile delivered to the project site without protective covering shall be rejected. After the protective covering has been removed, the Geotextile shall not be left uncovered for longer than fourteen (14) days, under any circumstances.

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C. The Owner shall approve the shipping and delivery schedule prior to shipment. The Owner shall designate the on-site storage area for the Geotextiles. Unloading and storage of Geotextiles shall be the responsibility of the Contractor.

D. Geotextiles that are damaged during shipping or storage shall be rejected and replaced at Contractor expense.

3.02 QUALITY ASSURANCE CONFORMANCE TESTING

A. At the option of the Engineer representative samples of Geotextiles shall be obtained and tested by the Engineer to assure that the material properties conform to these Specifications. Conformance testing shall be conducted by the Engineer and paid for by the Owner.

B. Conformance testing shall be completed at a minimum frequency of one sample per 100,000 square feet of Geotextile delivered to the project site. Sampling and testing shall be as directed by the Engineer.

C. Conformance testing of the Geotextiles shall include but not be limited to the following properties:

1. Mass Per Unit Area (ASTM D5261)

2. Grab Tensile Strength (ASTM D4632)

3. Trapezoidal Tear (ASTM D4533)

4. Puncture Resistance (ASTM D6241)

D. The Engineer may add to, remove or revise the test methods used for determination of conformance properties to allow for use of improved methods.

E. All Geotextile conformance test data shall meet or exceed requirements outlined in Table 1 of these Specifications for the particular category of Geotextile prior to installation. Any materials that do not conform to these requirements shall be retested or rejected at the direction of the Engineer.

F. Each roll of Geotextile will be visually inspected by the Engineer or his representative. The Engineer reserves the right to sample and test at any time and reject, if necessary, any material based on visual inspection or verification tests.

G. A Geotextile that is rejected shall be removed from the project site and replaced at the Contractor's expense. Sampling and conformance testing of the Geotextile supplied as replacement for rejected material shall be performed by the Engineer at Contractor's expense.

3.03 INSTALLATION

A. Geotextiles shall be placed to the lines and grades shown on the Drawings. At the time of installation, the Geotextile shall be rejected by the Engineer if it has defects, rips, holes, flaws, evidence of deterioration, or other damage.

B. It is the intent of these Specifications that Geotextiles used to protect natural drainage media be placed the same day as the drainage media to prevent soil, sediment or windblown soils to make contact with the drainage media.

C. The Geotextiles shall be placed smooth and free of excessive wrinkles. Geotextiles shall conform to and be in contact with the approved subgrade.

D. When the Geotextiles are placed on slopes, the upslope fabric portion shall be lapped such that it is the upper or exposed Geotextile.

E. Geotextiles shall be temporarily secured in a manner accepted by the Engineer prior to placement of overlying materials.

F. In the absence of specific requirements shown on the Drawings, the following shall be used for overlaps of adjacent rolls of Geotextile:

Geotextile Type / Application	Overlap of Adjacent Rolls(1) (Inches)	Transverse End Overlap (Inches)
Filter Geotextile	6 min	12 min
Separator - Roadway Applications	12 min	24 min
Separator - Slope Protection	18 min	24 min
Separator Geotextile	12 min	18 min

(1) Overlaps may be reduced if adjacent panels are sewn or heat bonded where approved by the Engineer.

G. Any Geotextile that is torn or punctured shall be repaired or replaced as directed by the Engineer by the Contractor at no additional cost to the Owner. The repair shall consist of a patch of the same type of Geotextile placed over the failed areas and shall overlap the existing Geotextile a minimum of 12-inches from any point of the rupture.

H. Any Geotextile that is subjected to excessive sediment buildup on its surface during construction shall be replaced by the Contractor prior to placement of overlying material.

Geotextile Property	Filter Geotextile	Type I Separator Geotextile	Type II Separator Geotextile
Geotextile Construction	Nonwoven Needle punched	Nonwoven Needle punched	Woven
Ultraviolet Resistance, (500 hrs.) ASTM D7238, Average % Strength Retention	70	70	70
Grab Tensile Strength (lbs.), ASTM D4632	120	160	315
Grab Tensile elongation (%) ASTM D4632	50	50	15
Trapezoid Tear Strength (lbs) ASTM D4533	50	60	120
Apparent Opening Size (AOS), (mm), ASTM D4751	0.212	0.212	0.425
Permittivity at 50 mm constant head (sec^{-1}), ASTM D4491	0.5	1.5	0.1
CBR Puncture Strength, ASTM D6241 (lb)	340	410	900

END OF SECTION

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SECTION 31 10 00

CLEARING, GRUBBING, AND SITE PREPARATION

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Includes all labor, material, equipment and appliances required for the complete execution of any additions, modifications, or alterations to existing building(s) and new construction work as shown on the Drawings and specified herein.

B. Principal items of work include:

1. Notifying all authorities owning utility lines running to or on the property. Protecting and maintaining all utility lines to remain and capping those that are not required in accordance with instructions of the Utility Companies, and all other authorities having jurisdiction.

2. Clearing the site within the Contract Limit Lines, including removal of grass, brush, shrubs, trees, loose debris and other encumbrances except for trees marked to remain.

3. Boxing and protecting all trees, shrubs, lawns and the like within areas to be preserved. Relocating trees and shrubs, so indicated on the Drawings, to designated areas.

4. Repairing all injury to trees, shrubs, and other plants caused by site preparation operations shall be repaired immediately. Work shall be done by qualified personnel in accordance with standard horticultural practice and as approved by the Engineer.

5. Removing topsoil to its full depth from designated areas and stockpiling on site where directed by the Engineer for future use.

6. Disposing from the site all debris resulting from work under this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 00 01 – Earthwork

B. Section 31 25 00 – Erosion and Sedimentation Control

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. New York State, Title 6 Department of Environmental Conservation, Chapter X Division of Water Resources.

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1.04 STREET AND ROAD BLOCKAGE

A. Closing of streets and roads during progress of the work shall be in compliance with the requirements of the Owner and other authorities having jurisdiction. Access shall be provided to all facilities remaining in operation.

1.05 PROTECTION OF PERSONS AND PROPERTY

A. All work shall be performed in such a manner to protect all personnel, workmen, pedestrians and adjacent property and structures from possible injury and damage.

B. All conduits, wires, cables and appurtenances above or below ground shall be protected from damage.

C. Provide warning and barrier fence where shown on the Drawings and as specified herein.

PART 2 – EXECUTION

2.01 CLEARING OF SITE

A. Before removal of topsoil, and start of excavation and grading operations, the areas within the clearing limits shall be cleared and grubbed.

B. Clearing shall consist of cutting, removal, and satisfactory disposal of all trees, fallen timber, brush, bushes, rubbish, sanitary landfill material, fencing, and other perishable and objectionable material within the areas to be excavated or other designated areas. Prior to the start of construction, the Contractor shall survey the entire Contract site and shall prepare a plan which defines the areas to be cleared and grubbed, trees to be pruned, extent of tree pruning, and/or areas which are to be cleared but not grubbed. This plan shall be submitted to the Engineer for approval. Should it become necessary to remove a tree, bush, brush or other plants adjacent to the area to be excavated, the Contractor shall do so only after permission has been granted by the Engineer.

C. Excavation resulting from the removal of trees, roots and the like shall be filled with suitable material, as approved by the Engineer, and thoroughly compacted per the requirements contained in Section 31 00 01 – Earthwork.

D. Unless otherwise shown or specified, the Contractor shall clear and grub a strip at least 15-ft. wide along all permanent fence lines installed under this Contract.

E. In temporary construction easement locations, only those trees and shrubs shall be removed which are in actual interference with excavation or grading work under this Contract, and removal shall be subject to approval by the Engineer. However, the Engineer reserves the right to order additional trees and shrubs removed at no additional

cost to the Owner, if such, in his opinion, are too close to the work to be maintained or have become damaged due to the Contractor's operations.

2.02 STRIPPING AND STOCKPILING EXISTING TOPSOIL

A. Erosion and sedimentation control measures shall be installed as per the Federal, State or Locally approved Erosion and Sedimentation Control Plan for the project and Specification Section 31 25 00 – Erosion and Sedimentation Control before any stripping and stockpiling of topsoil can occur.

B. Existing topsoil and sod on the site within areas designated on the Drawings shall be stripped to 12-inches or whatever depth it may occur and stored in locations directed by the Engineer. If topsoil is not stored, Contractor shall provide topsoil for restoration as needed.

C. The topsoil shall be free of stones, roots, brush, rubbish, or other unsuitable materials before stockpiling the topsoil.

D. Care shall be taken not to contaminate the stockpiled topsoil with any unsuitable materials.

2.03 GRUBBING

A. Grubbing shall consist of the removal and disposal of all stumps, roots, logs, sticks and other perishable materials to a depth of at least 6-inches below ground surfaces.

B. Large stumps located in areas to be excavated may be removed during grading operations, subject to the approval of the Engineer.

2.04 DISPOSAL OF MATERIAL

A. All debris resulting from the clearing and grubbing work shall be disposed of offsite by the Contractor as part of the work of this Contract. Material designated by the Engineer to be salvaged shall be stored on the construction site as directed by the Engineer for reuse in this Project or removal by others.

B. Burning of any debris resulting from the clearing and grubbing work will not be permitted at the site.

C. Contractor is prohibited from disposal of material onsite or the areas directly surrounding the project site.

2.05 WARNING AND BARRIER FENCE

A. The fence shall be made of a visible, lightweight, flexible, high strength polyethylene material. The fence shall be Guardian Visual Barrier as manufactured by TEMAX, or equal.

B. Physical Properties

Fence	
Color	International Orange
Roll Size	4' x 100'
Roll weight	9 lbs.
Mesh opening	1-3/4" x 1-3/4"
Posts	
ASTM Designation:	ASTM 702
Length:	6 feet long (T-Type)
Weight:	1.25 #/Foot (min)
Area of Anchor Plate:	14 Sq. In.

C. Drive posts 18 inches into ground every 8'. Wrap fence material around first terminal post allowing overlap of one material opening. Use metal tie wire or plastic tie wrap to fasten material to itself at top, middle and bottom. At final post, cut with utility knife or scissors at a point halfway across an opening. Wrap around and tie at final post in the same way as the first post.

D. Use tie wire or tie wrap at intermediate posts and splices as well. Thread ties around a vertical member of the fence material and the post and bind tightly against the post. For the most secure fastening, tie at top, middle and bottom. Overlap splices a minimum of four fence openings, tie as above, fastening both edges of the fence material splice overlap.

END OF SECTION

SECTION 31 23 19

DEWATERING

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Design, furnish all labor, materials, and equipment, and perform all work necessary to lower and control the groundwater levels and hydrostatic pressures to permit all excavations and construction to be performed in dry and stable conditions. The work shall include the following:

1. Design dewatering system, including engineering analysis by a qualified New York State licensed Professional Engineer.

2. Testing, operation, maintenance, supervision, and final dismantling and removal from the site of the dewatering system.

3. Compliance with all regulations relating to this work, including water discharge and sediment/debris disposal. The Contractor's dewatering approach shall not be allowed to exceed the maximum daily discharge, pretreatment scheme, or point of discharge permitted by the project permit applications without prior approval from the Engineer and Agencies granting permit authority.

4. The diversion, collection, and removal of all ice, snow and surface runoff from the work areas, and removal of groundwater from new excavations to permit construction in the dry.

5. Coordinate with the work requiring dewatering including Excavation, Support of Excavation (SOE), Waterproofing and Foundation Construction.

6. The cost of any replacement or rehabilitation of the subgrade or structures damaged due to dewatering system failures, or Contractor negligence.

7. Use of chloride-based deicing is not allowed on this project.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 00 01 – Earthwork

B. Section 31 25 00 – Erosion and Sediment Control

1.03 REFERENCE SPECIFICATIONS CODES AND STANDARDS

A. Without limiting the generality of other requirements of these Specifications, all work herein shall conform to or exceed the applicable requirements of the following documents to the extent that the provisions therein are not in conflict with the requirements of this Section.

011121

1. ASTM D1556 – Density of soil in place by the Sand Cone Method.

2. ASTM D2167 – Density of soil in place by the Rubber Balloon Method.

3. Bureau of Reclamation – Groundwater Manual Sediment Test by Imhoff Cone.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures:

1. Dewatering Qualification Data per Article 1.05 of this Section.

2. Existing Conditions: Using photographs, show the existing conditions of all adjacent construction and site improvements per Article 3.01 of this Section.

3. Shop Drawings indicating the following:

a. Plans showing the methods and location of dewatering and discharge including a sufficient number of detailed sections to clearly illustrate the scope of work.

1. Show arrangement, locations, and details of wells and sumps; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.

2. Include layouts of observation wells and flow-measuring devices for monitoring performance of dewatering system.

3. Relationship of the dewatering system components to existing site features, utilities, streets, and new construction.

b. Drawings shall bear the seal and signature of the qualified New York State licensed Professional Engineer who is in charge of designing the dewatering system and preparing the drawings.

c. List of materials and equipment to be used.

d. A sample of well records and monitoring forms to be maintained during construction.

4. Detailed description of the sequence of dewatering operations.

5. Dewatering well installation records indicating an identification number, location, dimensions, and installation procedures and materials.

6. Observation well installation records indicating an identification number, location, dimensions, and installation procedures and materials.

7. Emergency observation plan to be put into operation during failure of the dewatering system.

8. Monthly Dewatering System Monitoring Reports per Article 3.06 of this Section containing the following data on approved forms:

    a. For observation wells, daily piezometric levels shall be identified by date, time, well number and system (subsystem if multiple pumps are used) pumping rate. Piezometric levels shall be noted in feet of drawdown and groundwater elevation.

    b. For dewatering wells, suspended material test results shall be identified by date, time, well number, well pumping rate (if monitored) and system (subsystem if multiple pumps are used) pumping rate.

    c. Installation records for new wells.

9. Schedule and records of all maintenance tests for primary and standby dewatering systems including the following:

    a. Maintenance tests and water quality tests for suspended matter at the discharge point including date, time of day, elapsed times of tests procedures, components tested, suspended particles, resultant observations and well readings.

    b. Daily discharge rates.

    c. Installation and removal of wells.

    d. General observations of the system such as equipment running times, and failures.

10. Dewatering well (and sump) removal records per Part 3 of this Section.

11. Observation well removal records per Part 3 of this Section.

1.05 QUALITY ASSURANCE

A. The Contractor shall be solely responsible for the arrangement, location, and depths of the dewatering system necessary to accomplish the work described herein.

B. The Contractor shall be solely responsibility for monitoring the performance of the dewatering system to meet pretreatment and permitted discharge requirements.

C. Contractor shall employ the services of a Dewatering Specialist or Subcontractor having the following qualifications:

1. Have completed at least five (5) successful dewatering projects of equal size and complexity and with equal systems within the last five (5) years.

2. Retain the services of a field representative having a minimum of five (5) years of experience in installation of well points, sumps, deep wells, or equal systems.

3. Retain the services of a New York Registered Professional Engineer having a minimum of five (5) years of experience in the design of well points, sumps, deep wells, or equal systems.

D. Dewatering shall prevent the loss of fines, seepage, boils, quick conditions or softening of the foundation strata while maintaining stability of the sides and bottom of the excavation and providing dry conditions for construction operations.

E. The Contractor shall be responsible for all remedial action due to problems arising from improper/illegal dewatering.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Provide casings, well screens, sump screens, piping, fittings, pumps, power, controls and other items required for dewatering system and suited for their intended purpose.

B. Materials and equipment used in the dewatering system shall adhere to accepted industry standards and be in good operating condition and able to perform satisfactorily over the required duration of the construction dewatering.

C. Provide treatment equipment as necessary to meet permit discharge requirements. Treatment to remove sediment and adjust for pH should be anticipated.

C. Provide sand and gravel filter materials around the dewatering well screens/sump screens. Wrapping geotextile fabric directly around the well screens shall not be allowed. Surging of the natural formation to form a "gravel pack" is strictly prohibited.

D. Materials, especially well and sump screens, shall be compatible with the environment to prevent erosion, deterioration, and clogging.

E. Provide standby power supply and/or emergency generator capabilities for maintaining uninterrupted construction dewatering.

F. Provide and store auxiliary dewatering equipment, consisting of pumps and hoses on the site in the event of breakdown. At least one (1) spare pump shall be stored onsite for every five (5) used.

G. Provide temporary pumps, pipes, hoses, flumes, or channels for the transport of dewatering discharge water to the outfall location after required pre-treatment.

H. Provide cement grout for well abandonment.

I. Provide sampling ports and flow meters.

PART 3 – EXECUTION

3.01 EXAMINATION OF THE SITE

A. Become familiar with the surface and subsurface site conditions.

B. Obtain the data required to analyze the water and soil environment at the site in order to assure that the materials used for the dewatering systems will not erode, deteriorate, clog or otherwise hinder the system's performance during the period of the dewatering.

C. Prior to the execution of the work, the Contractor, Owner and Engineer shall jointly survey the condition of adjoining structures. Photographs and records shall be made of any prior settlement or cracking of structures, pavements, and the like, that may become the subject of possible damage claims.

D. Examine the areas and conditions where dewatering system is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

E. Execution of any earth excavation, installing earth retention systems, and dewatering shall not commence until the related submittals have been reviewed and approved by the Owner and Engineer, to confirm that satisfactorily addressed and the geotechnical instrumentation has been installed and baselined.

3.02 DESIGN

A. The dewatering system shall be capable of relieving all hydrostatic pressure against the height of the excavation walls and of lowering the hydrostatic level below the bottom of the base slab a minimum of two (2) feet below the lowest excavation in the work areas both prior to excavation, and during excavation and construction.

B. The dewatering system shall be segmented so that if the operation of any one segment is disrupted, the remaining segment plus activated redundant components are capable of maintaining the groundwater at the stated levels.

C. Provide, operate and maintain all ditches, berms, site grading, sumps and pumping facilities to divert, collect and remove all surface water from work areas. All collected water shall be discharged into the outfall pipe.

D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction, or completed. The dewatering effluent water will be discharged under a SPDES permit. Compliance with the SPDES permit requirements should be incorporated into the dewatering system design.

E. Provide pipe and pumps of sufficient size and quantity to be able to flood the excavation within 12 hours in an emergency situation. Restoration of the working area shall be carried out by the Contractor at no additional cost to the Owner.

F. Carry the dewatering system discharge out of the area of the excavation.

G. Provide a standby dewatering system that meets the following requirements:

1. Provide 100 percent standby power.

2. Provide a 15 percent minimum increase in the number of wells or pumping volume and related equipment required to operate the dewatering system installed and ready to operate.

3. Provide a minimum of three separate power units for the standby power system and one installed auxiliary unit for each individually powered pump.

4. Provide separate discharge lines from each well or common lines with valves such that any well or wells that malfunction or are damaged can be isolated form the others.

5. The systems shall be laid out and designed in such a way that portions of the system may be isolated for routine maintenance or repair in case of accidental damage without affecting the normal operation of the system.

H. Provide contracts or sufficient on-site fuel to maintain a five-day supply on site for fuel-powered systems.

I. Provide observation wells to determine compliance with dewatering requirements as indicated on the Drawings, Shop Drawings, and the Engineer.

J. Designate certain observation wells as emergency observation wells.

3.03 INSPECTION

A. All tests and inspections require the witnessing and written approval of the Owner and Engineer.

B. Provide safe access for the Owner and Engineer to perform testing and inspection.

C. The Owner and Engineer will provide oral and written notice to the Contractor for all tests and inspections that do not meet approval.

3.04 INSTALLATION AND TESTING

A. Install the dewatering system from the existing ground surface or from the bottom of an excavation which is located above the natural groundwater level.

B. Pump each pumping well and/or dewatering sump individually at its maximum or design flow and take a water sample using the following procedures:

1. Obtain samples from stopcocks located along the discharge lines at points of high turbulence or between 4 and 8 o'clock on the perimeter of straight sections of pipe.

2. Flush the stopcock for a few seconds before taking a sample.

3. Take a 1-liter sample with the stopcock fully open.

C. Test the sample following the Sediment Test by Imhoff Cone for two to three minutes and measure the volume of settled materials to the nearest 0.01 milliliters (0.01 milliliters = 10 ppm).

D. All pumping wells and dewatering sumps shall be evaluated as follows:

1. Wells/sumps producing 10 ppm or less shall be accepted.

2. Wells/sumps producing between 10 and 20 ppm may be accepted by the Engineer based on the evaluation of average ppm for all wells, ppm of adjacent wells, and total quantity of water which is actually pumped to dewater the excavation.

3. Wells/sumps producing more than 20 ppm shall be remediated to provide acceptable testing results, or backfilled and reinstalled if acceptable results cannot be achieved.

E. Observation wells shall consist of a standpipe or riser of minimum 1.0-inch inside diameter and a minimum three (3) foot long well-point screen or slotted PVC section at the bottom. Observation wells shall be installed as follows:

1. Jetting installation method for observation wells will be considered acceptable except for observation wells installed within 10 feet of existing structures, piping or utilities.

2. Employ Case Boring Techniques for all observation wells within 10 feet of existing structures, piping, or utilities and backfill the annulus between the well point or riser and the natural soil with a free-flowing granular material similar to Ottawa Sand.

F. Test observation wells by adding or removing water from the riser to demonstrate their proper functioning.

G. Test the standby dewatering system with the following procedures:

1. Shut off the primary power source and demonstrate that the standby power can be activated prior to the groundwater level rising to within one (1) foot of the bottom of base slab elevation and that the standby power source is adequate to draw the groundwater level back down to the Contractor's design depth or to the minimum required depths.

2. Shut off one segment of the system and show that redundant components can be activated prior to the groundwater level rising to within one (1) foot of the bottom of base slab elevation and that the system is adequate to draw the groundwater level back down to the Contractor's design depth or to the minimum required depths.

3. If the dewatering system fails to meet either performance requirement, the Contractor shall draw the groundwater level to a greater depth, add wells, or modify the system such that it will be in conformance with these requirements when retested.

H. Provide temporary grading to facilitate dewatering and control of surface water.

I. Protect and maintain temporary erosion and sedimentation controls during dewatering operations, which are specified in Section 31 25 00 - Erosion and Sediment Control.

3.05 DEWATERING PROCEDURE

A. Maintain dewatering system in operation as required to properly dewater the excavation until work which requires dewatering is complete. In addition, do not excavate until the dewatering system is operational and the water level has been lowered below the anticipated depth of excavation.

1. The performance of the dewatering system shall be monitored and maintained as the excavation progresses deeper.

2. All equipment, berms, ditches, trenches and sump installations shall be checked and maintained daily to remove debris and keep open flow paths.

3. Adjust pumping speed/ flow rates and/or pipe sizes to achieve required dewatering.

B. Perform dewatering in such a manner as to prevent undermining or disturbing foundations of existing structures, utilities, or of work ongoing or previously completed. Schedule the dewatering work to coordinate with all the other related work such as excavation support systems, excavation, placing of concrete walls and slabs, and any other operations by other Contractors that might be affected by this work.

C. Discontinue open pumping from sumps and ditches, if such pumping is resulting in boils, loss of fines, softening of the ground, or instability of the slopes. Modify dewatering plan and resubmit to the Engineer at no additional cost to the Owner.

D. Operate the dewatering system continuously twenty-four (24) hours per day, seven (7) days per week until all structures have been satisfactorily constructed, including placement of fill materials, and no longer require dewatering.

E. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.

F. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

G. Heat and light system (as necessary) for continuous operation, including during winter months, at no additional cost to the Owner.

3.06 MONITORING

A. Measure the water levels to the nearest one-tenth foot in all observation wells and submit the readings daily.

B. Measure the concentration of suspended material in the discharge water of each well once every two days. Wells which exceed the acceptable level of solids concentration shall be replaced.

C. Observe and record the total discharge volume and average total pumping rate of the pumping system (record all system flow meters) on a daily basis.

D. Test the performance of the standby system and all components by demonstrating that the system is operational at least every two weeks.

E. Test the observation wells every two weeks by adding and removing water from the risers to demonstrate their proper functioning.

F. Observation wells that become inoperable shall be immediately replaced while construction is halted if the Engineer determines that the observation well is critical.

G. Repair leaks promptly to prevent damage.

H. Remove and add riser pipe of each observation well located within the excavation as construction progresses until the well conflicts with the structure. When the conflict occurs, abandon the observation well, fill it with grout, and cut the riser off at grade.

I. In the event of a dewatering system failure, take the following steps:

1. Conduct in situ density tests conforming to ASTM D1556 or ASTM D2167 immediately above an at the structure founding grades.

2. Remove all soils that show unacceptable density and replace them with compacted fill as indicated in Section 31 00 01 – Earthwork.

3. Test the repaired soils as required by the Owner and Engineer to verify that they have been returned to their original in situ state or better.

4. Repair or replace damaged structures.

3.07 REMOVAL OF DEWATERING SYSTEM

A. Obtain written approval from the Owner and Engineer prior to ceasing dewatering operations. The Engineer shall provide confirmation that the structural components provide adequate weight to prevent buoyancy.

B. Obtain written approval from the Engineer to remove dewatering components when the dewatering system is no longer needed.

C. Remove all dewatering wells/sumps, buried and surface piping, cables, pump foundations, structural supports, and all other components and/or support facilities.

D. Backfill as specified in Section 31 00 01 – Earthwork, all trenches and excavations below final grades or in fill areas.

E. The Contractor shall be responsible for proper decontamination of dewatering system equipment and proper disposal of all residual contaminated materials (such as filter material and settlement silts) accumulated during operation of the pretreatment system equipment.

F. The Contractor shall repair all penetrations of the foundation slab required for the dewatering system in a manner that maintains the warranty of the waterproofing system.

G. Repair any damage caused by the Contractor during dewatering operations at no additional cost to the Owner.

H. Provide documentation of dewatering and observation well removal including the date of removal, well number, location, procedures, and materials used.

END OF SECTION

SECTION 31 25 00

EROSION AND SEDIMENTATION CONTROL

PART 1 – GENERAL

1.01 THE REQUIREMENTS

A. The Contractor is responsible for implementing Best Management Practices (BMPs) to prevent and minimize erosion and resultant sedimentation in all cleared and grubbed areas during and after construction. This item covers the work necessary for the installation of structures and measures for the prevention of soil erosion and control of sedimentation. The Contractor shall furnish all material, labor and equipment necessary for the proper installation, maintenance, inspection, monitoring, reporting, and removal (where applicable) of erosion prevention and sediment control measures and, if applicable, to cause compliance with all local permits.

B. Any land disturbance as the result of modifications to a site's drainage features or topography requires protection from erosion and sedimentation.

C. All excavations shall be in conformity with the lines, grades, and cross sections shown on the Contract Drawings or established by the Engineer.

D. It is the intent of this Specification that the Contractor conducts the construction activities in such a manner that erosion of disturbed areas and off-site sedimentation be absolutely minimized.

E. All work under this Contract shall be done in conformance with and subject to the limitations of the New York State Environmental Conservation Rules and Regulations, Title 6, Chapter X, Part 750.

F. The Contractor shall develop and implement such additional techniques as may be required to minimize erosion and off-site sedimentation. The location and extent of erosion and sedimentation control devices shall be revised at each phase of construction that results in a change in either the quantity or direction of surface runoff from constructed areas. All deviations from the erosion and sedimentation control provisions shown on the Contract Drawings shall have the prior acceptance of the Engineer and shall be completed at no additional cost to the Owner.

G. Erosion and sedimentation controls applicable to this project shall be as shown on the Contract Drawings, as specified herein, as indicated by the Engineer and as detailed in the New York State Standards and Specifications for Erosion and Sediment Control.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 00 01 – Earthwork

B. Section 31 05 19 – Geotextiles

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C. Section 31 10 00 – Clearing, Grubbing, and Site Preparation

D. Section 32 11 00 – Surface Restoration

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of other requirements of these specifications, all work hereunder shall conform to the applicable requirements of the referenced portions of the following documents, to the extent that the requirements therein are not in conflict with the provisions of this Section.

1. New York State Environmental Conservation Rules and Regulations, Title 6, Chapter X, Part 750

2. New York Standards and Specifications for Erosion and Sediment Controls

B. See Specification Section 01 42 00 – References.

1.04 REGULATORY COMPLIANCE

A. Land disturbance activities are not authorized to begin until after all required erosion and sediment control permits are obtained from the United States and the State of New York. Contractor shall comply with requirements specified in the Contract Documents or by the Engineer. Contractor shall also comply with all other laws, rules, regulations, ordinances, guidelines, and requirements concerning soil erosion and sediment control established in the United States and the State of New York. The following documents and the documents referenced therein define the regulatory requirements for this Section.

1. SPDES PERMIT: The New York State Pollutant Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activities governs land disturbance or construction activities of one (1) acre or more in New York State or located in the New York City Watershed East of the Hudson that disturb between five thousand (5000) square feet and one (1) acre of land. On applicable sites, Contractor is responsible for complying with terms and conditions of this permit.

2. New York State Standards and Specifications for Erosion and Sediment Control (NYSSSE&SC): Contractor shall follow Standards and Specifications of the New York State Department of Environmental Protection's (NYSDEC's) Standards and Specifications for Erosion and Sediment Control, latest edition.

3. SWPPP: When a Storm Water Pollution Prevention Plan (SWPPP) is provided in the Contract Documents, the Contractor shall follow the practices described in the SWPPP. (See the Appendix for the SWPPP, if applicable).

B. Storm Water Pollution Prevention Plans (SWPPPs)

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1. The Contractor shall abide by the site-specific Stormwater Pollution Prevention Plan.

    a. During the period beginning on the effective date of the permit and lasting until expiration, the Permittee is authorized to discharge stormwater associated with construction activity including clearing, grading and excavation activities resulting in the disturbance of land and related support activities. Such discharges shall be controlled, limited and monitored.

1.05 SUBMITTALS

A. Prior to the start of the work, the Contractor shall prepare and submit a plan for implementing the temporary and permanent erosion and sedimentation control measures as shown on the Erosion and Sediment Control Plan approved by the appropriate regulatory authority. Construction work shall not commence until the schedule of work and the methods of operations have been reviewed and approved.

B. Qualified Inspector: The Contractor shall submit a Qualified Inspector in accordance with Part IV.C. of the NYSDEC SPDES General Permit for Stormwater Discharges to perform site inspections as stated in Article 3.12 of this specification. Contractor shall not start any work that will result in the disturbance of the site until the Engineer has approved the credentials of the Qualified Inspector.

C. In accordance with the procedures and requirements set forth in the General Conditions Division 1 and Section 01 33 00 – Submittal Procedures, the Contractor shall submit the following:

    1. Name and location of all material suppliers.

    2. Certificate of compliance with the standards specified above for each source of each material.

    3. List of disposal sites for waste and unsuitable materials and evidence of all required permits for use of those sites.

1.06 EROSION AND SEDIMENTATION CONTROL DEVICES

A. Silt Fence

    1. Silt Fence shall be constructed at the locations shown on the Drawings, and at other locations indicated by the Engineer. Silt Fence shall not be installed across streams, ditches, or waterways. Silt Fence shall be designed, installed and maintained in accordance with the requirements of Section 5 of the NYSSSE&SC.

B. Inlet Erosion Control Measures

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1. Yard, Curb and other Inlet Erosion Control Measures shall be constructed at the locations shown on the Contract Drawings, at other locations indicated by the Engineer. Inlet erosion control measures shall be used to prevent or limit the introduction of sediment to storm drain systems and allow early use of the of the storm drainage system. Curb Inlet Erosion Control Measures shall be designed, installed and maintained in accordance with the requirements of Section 5 of the NYSSSE&SC.

C. Temporary Gravel Construction Entrance

1. Temporary Gravel Construction Entrances shall be located at points where vehicles enter and leave a construction site, or at other locations indicated by the Engineer. Temporary Gravel Construction Entrances shall be designed, installed and maintained in accordance with the requirements of requirements of Section 5 of the NYSSSE&SC.

D. Portable Sediment Tanks

1. Portable Sediment Tanks shall be manufactured and installed as shown on the Drawings and as specified herein. They shall be constructed of steel with interior baffles and sized sufficiently for inflow and outflow requirements. Portable sediment tanks shall be cleaned out and maintained in accordance with Part 3 of this Section and Section 5 of the NYSSSE&SC to the satisfaction of the Engineer until the site has been stabilized.

E. Anchored Stabilization Matting

1. Anchored stabilization matting shall be installed on all seeded earthen slopes steeper than 3 horizontal to 1 vertical. Matting is not required on slopes stabilized with sod, rock riprap or hard armor material.

1.07 GUARANTEE

A. All restoration and re-vegetation work shall be subject to the one-year guarantee period of the Contract as specified in the General Conditions.

PART 2 – GENERAL

2.01 MATERIALS

A. Materials for use in erosion and sedimentation control devices shall be in accordance with the New York Standards and Specifications for Erosion and Sediment Controls.

B. All erosion and sediment control bid prices shall include all excavation, grading, maintenance, legal sediment disposal, permits and all other work and appurtenances necessary to design, install and maintain the sediment and erosion control measures as

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detailed herein and in accordance with New York Standards and Specifications for Erosion and Sediment Controls.

2.02 SILT FENCE

A. Silt Fence shall be a woven geotextile filter fabric made specifically for sediment control. Filter fabric shall not rot when buried and shall resist attack from soil chemicals, alkalies and acids in the pH range from 2 to 13 and shall resist damage due to prolonged ultraviolet exposure. Filter fabric shall be Type FX-11, as manufactured by Carthage Mills, Geotex 910SC as manufactured by Synthetic Industries, Inc., Amoco 2130 as manufactured by Amoco Fabrics & Fibers Co. or approved equal.

B. Filter fabric for the silt fence shall have the following minimum properties:

	Value	Test Method
Grab Tensile Strength	110 lbs	ASTM D 4632
Grab Elongation	20%	ASTM D 4632
Trapezoid Tear Strength	50 lbs	ASTM D 4533
Mullen Burst Strength	300 lbs	ASTM D 3786
Puncture Strength	60 lbs	ASTM D 4833
Retained Strength (500 hrs. accelerated UV exposure)	70%	ASTM D 4355
Filtration Efficiency	75%	VTM-51
Flow Rate	25 gal/min/ft^2	ASTM-D4491
Height	36 inches	

C. Posts for silt fence shall be steel and shall have the following properties:

ASTM Designation:	ASTM A702
Length:	5-Feet Long (T-Type)
Weight:	1.25#/Foot (min.)
Area of Anchor Plate:	14 Sq. In.

Note: Five (T) Fasteners shall be furnished with each post.

D. Wire Fabric for the silt fence shall have the following properties:

Wire Fabric Designation:	832-12-10-12.5 Class 1
Designation:	ASTM A116
Width:	32"
Number of Line Wires:	8
Stay Wire Spacing:	12"
Line and Stay Wires:	12.5 Ga.
Top and Bottom Wires:	10 Ga.
Wire Coating:	ASTM Class 1 Zinc Coating

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Silt Fence shall be installed and maintained in accordance with Part 3 of this Section, and 5 of the NYSSSE&SC, to the satisfaction of the Engineer until the site has been stabilized. The cost of Silt Fence shall include the fabric, posts, wire fabric, excavation and all maintenance and restoration activities required.

2.03 INLET EROSION CONTROL MEASURES

A. Yard, Curb and other Inlet Erosion Control Measures shall be constructed at the locations shown on the Contract Drawings, at other locations indicated by the Engineer. Inlet erosion control measures shall be used to prevent or limit the introduction of sediment to storm drain systems and allow early use of the of the storm drainage system. Curb Inlet Erosion Control Measures shall be designed, installed and maintained in accordance with the requirements of Section 5 of the NYSSSE&SC.

2.04 STABILIZED CONSTRUCTION ENTRANCES

A. Stabilized construction entrances shall be constructed as shown on the Drawings and as specified herein. Temporary gravel construction entrances shall be maintained in accordance with Part 3 of this Section and Sections 5 and 7A of the NYSSSE&SC to the satisfaction of the Engineer until the site has been stabilized. The cost of the stabilized construction entrances shall include the gravel and all maintenance activities required.

2.05 ROLLED EROSION CONTROL MATTING (RECM)

A. Single Net Straw Blanket

1. Single net straw blankets shall be used for slopes 3:1 and shallower (length to width ratio).

    a. Single Net Straw Blanket shall be ECS-1B Single Net Biodegradable Rolled Erosion Control product as manufactured by East Coast Erosion Control Blankets, Bernville, PA or Curlex I Single Net Excelsior Erosion Control Blanket as manufactured by American Excelsior Company, Arlington, TX or approved equal.

B. The mat shall consist of clean wheat straw from agricultural crops made into a knitted straw mat that is machine assembled. The straw shall be evenly distributed throughout the mat. The mat shall be covered with a biodegradable synthetic mesh attached to the straw with degradable thread. Non-biodegradable mesh is not acceptable.

C. The Contractor shall place the Single Net Straw Blanket immediately after the seeding operation. The netting shall be on top with the filling material in contact with the soil.

D. Stakes: Stakes for RECM shall be of sound quality hardwood with a minimum dimension of 24 inch x 2 inch x 2 inch and shall be 100% biodegradable. Wood shall not be pressure treated. 100% biodegradable stakes such as the E-Staple by American Excelsior Company or approved equal are also acceptable.

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E. The Contractor shall immediately repair or replace any section of RECM which is not functioning properly or has been damaged in any way until a stable planting cover has been established.

F. RECM shall be installed and maintained in accordance with Part 3 of this Section and the Contract Drawings. The cost for Rolled Erosion Control Products shall include all excavation, grading, and materials, and all maintenance activities.

2.06 TEMPORARY SOIL STABILIZER

A. The temporary agent for soil erosion control shall consist of an especially prepared highly concentrated powder which, when mixed with water, forms a thick liquid such as "MA-60 Soil Stabilizer" by Enviroseal Corporation, "BIND | ATLAS SUPERDUTY" by Quattro Environmental, Inc., or "VERTEX" by LSC Environmental Products, Inc., or approved equal, and having no growth or germination inhibiting factors. The agent shall be used for hydroseeding grass seed in combination with other approved amendments resulting in a highly viscous slurry which, when sprayed directly on the soil, forms a gelatinous crust.

PART 3 – GENERAL

3.01 INSTALLATION AND MAINTENANCE

A. Erosion and sedimentation control devices shall be established prior to or concurrent with the clearing operations in a given area. Where such practice is not feasible, the erosion and sedimentation control device(s) shall be established immediately following completion of the clearing operation.

B. The Contractor shall furnish the labor, materials and equipment required for routine maintenance of all erosion and sedimentation control devices. Maintenance shall be scheduled as required for a particular device to maintain the removal efficiency and intent of the device. Maintenance shall include but not be limited to 1) the removal and satisfactory disposal of accumulated sediment from traps or silt barriers and 2) replacement of filter fabrics used for silt fences and stone used in temporary sediment traps, stone filters, gravel construction entrances, etc. Sediment removed from erosion and sedimentation control devices shall be disposed of in locations that will not result in off-site sedimentation as acceptable to the Engineer, at no additional cost to the Owner.

3.02 SILT FENCE

A. Silt fence shall be erected as shown on the Drawings and specified herein. Silt fence shall be erected and maintained to the satisfaction of the Engineer until a vegetative ground cover has been established. Replacement of the filter fabric, if required by the Engineer, will be at the Contractor's expense.

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B. Silt fence shall be erected around all catch basins which are located downstream from any construction work. Should any catch basins be indicated to be relocated or modified, silt fence shall be utilized until work is completed on the catch basins. Upon completion of the modification, the area shall be rough graded, as shown on the Drawings, until the end of the project, at which time final grading shall occur.

C. Inspect silt fence at least once a week and after each rainfall. Make any required repairs immediately.

D. Should the fabric of a silt fence collapse, tear, decompose or become in-effective, replace it promptly.

E. Remove sediment deposits as necessary to provide adequate storage volume for the next rain and to reduce pressure on the fence. Take care to avoid undermining the fence during cleanout.

F. Remove all fencing materials and unstable sediment deposits and bring the area to grade and stabilize it after the contributing drainage area has been properly stabilized. Removal of any silt fence shall be permitted only with the prior approval of the Engineer, or the local governing agency.

3.03 STABILIZED CONSTRUCTION ENTRANCE

A. The Contractor shall provide temporary gravel construction entrances at all locations noted on the Contract Drawings, and at all other locations as may be directed by the Engineer.

B. Maintain the gravel pad in a condition to prevent mud or sediment from leaving the construction site. This may require periodic topdressing with 2-inch stone. After each rainfall, inspect each construction entrance and clean out as necessary. Immediately remove all objectionable materials spilled, washed, or tracked onto public roadways.

3.04 ROLLED EROSION CONTROL MATS (RECMS)

A. RECMs shall be biodegradable and installed as shown on the Contract Drawings, and at other locations indicated by the Engineer, as specified herein.

B. RECMs shall be utilized to aid stabilization of slopes 3H:1V or greater and with more than 10 feet of vertical relief, and to aid in permanent stabilization of vegetated channels where runoff velocity will exceed 2 feet/second. RECMs should also be used when mulch cannot be adequately tacked and where immediate ground cover is required to prevent erosion damage.

C. Base soil shall be tilled to a twelve-inch depth except where bedrock layers are encountered or steepness of slope does not allow operation of tilling equipment; rake in three inches of organic matter and 6-inches of top soil prior to RECM placement.

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D. Seeding shall be per the designated limits of the planting zones and schedules as shown on the Contract Documents. Permanent seed shall be placed if it is the correct time of year for installation in accordance with detailed specification 32 11 00 – Surface Restoration.

E. The Contractor shall unroll the erosion control fiber matting along the slope face anchoring the blanket into the top, bottom end, and sides of the slope by 'keying' the blanket a minimum of 1 foot into the existing ground. Matting shall be placed loosely and in full contact with the soil. Matting shall be laid within footer trench with stones then placed on erosion control mat.

F. Blanket edges (blankets side by side at a given elevation) shall overlap approximately 8 inches, with the upstream blanket on top. Stakes shall straddle the edge of the blanket on the top and the underlying blanket.

G. Blanket ends (blankets ending upslope from down slope blankets) shall overlap approximately 8 inches with the upslope blanket over the down slope blanket. The overlapping area shall be secured with staking spaced at a minimum of 2 feet on center.

H. Matting shall be "keyed" into ground 12 inches on the top and bottom of slopes. Secure with 24 inch x 2 inch x 2 inch stakes, 2 per square yard for slopes less than 2:1. Stakes shall be installed so that no more than 2 inches of the stake remains above finished grade.

I. Permanent seeding for RECM areas shall be seeded with mix as described in the Contract Documents.

J. Extreme care must be taken by vegetation planting crews so that RECM is not excessively damaged during planting installation. At no time can the mat be cut more than 6 inches beyond the root ball of plant being installed.

3.05 TEMPORARY AND PERMANENT STABILIZATION OF DISTURBED AREAS

A. The Contractor shall provide temporary or permanent ground cover adequate to restrain erosion on all disturbed areas that will be left unworked for periods exceeding 15 working or 30 calendar days.

1. Reseed and mulch temporary seeding areas where seedling emergence is poor, or where erosion occurs, as soon as possible. Do not mow. Protect from traffic as much as possible.

2. Generally, a stand of vegetation cannot be determined to be fully established until soil cover has been maintained for one full year from planting. Inspect seeded areas for failure and make necessary repairs and reseedings within the same season, if possible.

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3. **Reseeding** – If a stand has inadequate cover, re-evaluate choice of plant materials and quantities of lime and fertilizer. Re-establish the stand after seedbed preparation or over-seed the stand. Consider seeding temporary, annual species if the time of year is not appropriate for permanent seeding.

4. If vegetation fails to grow, soil must be tested to determine if acidity or nutrient imbalance is responsible.

5. **Fertilization** – On the typical disturbed site, full establishment usually requires refertilization in the second growing season. Fine turf requires annual maintenance fertilization. Use soil tests if possible or follow the guidelines given for the specific seeding mixture.

3.06 TEMPORARY SEDIMENT TRAPS, AND SEDIMENT BASINS

A. Temporary sediment traps shall be designed, installed and maintained in accordance with the requirements of Section 5 of the NYSSSE&SC. Sediment basins shall be designed, installed and maintained in accordance with the requirements of Section 5 of the NYSSSE&SC. The Contractor shall provide these structures at all locations shown on the Contract Drawings and at all other locations as may be directed by the Engineer.

B. Care shall be taken to ensure that proper site preparation operations are conducted prior to trap or basin construction. Clear, grub and strip embankment location.

C. A cut-off trench shall be excavated along the center line of the earth fill embankment for sediment basins and skimmer sediment basins. Keep the trench dry during backfilling and compaction operations.

D. Fill material shall be free of roots, woody vegetation, rocks, and other objectionable materials. Fill shall be placed in 6-to-8-inch layers and compacted. Construct the embankment to an elevation 10 percent (minimum of 6 inches) higher than the design height to allow for settling.

E. Inlets to the sediment traps and basins shall be immediately armored with anchored stabilization matting or riprap so as to prevent erosion. Use diversions to divert sediment-laden water to the upper end of the basin.

F. Shape the sediment trap or basin to the specified dimensions as shown on contract drawings.

G. Following construction of the embankment, clear the sediment trap or basin area below the crest elevation of the spillway to facilitate sediment cleanout. Provide access for cleanout of accumulated sediment.

H. Spillway/outlet configuration shall be constructed as specified below.

I. Temporary sediment trap

1. Provide emergency bypass in natural, stable areas, located so that flow will not damage the embankment.

2. Securely attach the riser to the barrel or barrel stub to make a watertight structural connection. Secure all barrel connections with approved watertight assemblies. Install anti-seep collar(s) as noted on the Contract Drawings. Ensure that the pipe stays in firm contact with its foundation when compacting fill around the pipe. Do not use pervious material as backfill around the pipe. Anchor the riser to prevent floatation. Install trash guard to prevent the riser and barrel from becoming clogged.

3. Install basin dewatering mechanism as noted on the Contract Drawings.

4. Install outlet protection as specified at principal spillway outlet. Install the emergency spillway in undisturbed soil and provide stabilization as specified.

5. Sediment traps and basins shall be constructed so that the area disturbed and resulting erosion is minimized. The emergency spillway, embankment, and all other disturbed areas above the crest of the principal spillway are to be stabilized immediately after construction with vegetation or temporary or permanent anchored stabilization matting as shown on the Contract Drawings.

6. Sediment traps and basins may attract children and should be considered dangerous. Steep side slopes should be avoided and fences with warning signs may be necessary if trespassing is likely.

7. Inspect temporary sediment traps, sediment basins, and skimmer sediment basins once a week and within 24 hours after any storm event of greater than ½ inch of rain per 24-hour period. Repairs shall be made immediately.

    a. Sediment, limbs and other debris shall be cleared and the trap or basin shall be restored to its original dimensions when it accumulates to one-half the design depth or more frequently as directed by the Engineer. Sediment material removed from traps and basins shall be disposed of by the Contractor in locations that will not result in off-site sedimentation as acceptable to the Engineer, at no additional cost to the Owner. If no suitable on site locations are available, all such sediment will be legally disposed of off site, at no additional cost to the Owner.

    b. The embankment, spillways and outlet shall be checked for erosion damage and the embankment shall be checked for piping and settlement. Immediately fill any settlement of the embankment to slightly above design grade. Any riprap displaced from the spillway must be replaced immediately. Replace contaminated gravel facing of riprap outlets as necessary. Inspect vegetation. Reseed, re-mulch, or reinstall matting as necessary.

c. Debris shall be removed from the skimmer to prevent clogging. Special precautions shall be taken in winter to prevent the skimmer from plugging with ice.

d. Sediment shall be removed and trap restored to original dimensions when the sediment had accumulated to ½ of the design depth. Sediment removed from the trap shall be deposited in a protected area and in such a manner that it will not erode.

3.07 ADDITIONAL REQUIREMENTS

A. All storm sewer piping shall be blocked at the end of every working day until the inlet is constructed above grade.

B. All streets around the construction area shall be scraped as necessary to prevent accumulation of dirt and debris.

C. The Contractor shall provide adequate means to prevent any sediment from entering any storm drains, curb inlets (curb inlet filter box), ditches, streams, or bodies of water downstream of any area disturbed by construction. Excavation materials shall be placed upstream of any trench or other excavation to prevent sedimentation of offsite areas. Silt fence will be provided, at no additional cost to the Owner, around excavation materials if deemed necessary by the Engineer. In areas where a natural buffer area exists between the work area and the closest stream or water course, this area shall not be disturbed.

D. The Engineer may direct the Contractor to place any additional sediment and erosion control devices at other locations not shown on the Drawings.

3.08 INSPECTIONS AND MAINTENANCE

A. The Contractor shall designate a Qualified Inspector to perform inspections required by this Section. The following areas are to be inspected and maintenance performed, if needed, at least once every 7 calendar days and within 24 hours of a rainfall event that has a precipitation of 1/2 inch or greater.

1. Disturbed areas of the construction site that have not undergone final stabilization.

2. Erosion and sediment control structures.

3. All locations where vehicles enter or exit the site.

4. Material storage and construction laydown areas that are exposed to precipitation and have not been finally stabilized

B. When a SWPPP is provided in the Contract Documents, the Qualified Inspector shall follow the practices inspection and maintenance requirements described in the SWPPP.

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(See the Appendix for the SWPPP, if applicable). All appropriate records required by the SWPPP shall be maintained on site.

C. Immediate action will be taken to correct deficiencies to BMP's. The State reserves the right to stop all construction activities not related to maintaining BMP's until such deficiencies are repaired.

D. In areas that have been finally stabilized, inspections and, if necessary, maintenance by Contractor will occur at least once per month for the duration of the contract or project, whichever is longer.

E. During inspections the following will be observed and appropriate maintenance procedures taken:

1. The conformance to specifications and current condition of all erosion and sediment control structures.

2. The effectiveness and operational success of all erosion and sediment control measures.

3. The presence of sediments or other pollutants in storm water runoff at all runoff discharge points

4. If reasonably accessible, the presence of sediments or other pollutants in receiving waters.

5. Evidence of off-site tracking at all locations where vehicles enter or exit the site.

F. An inspection checklist is included in the SWPPP, if required, and is attached at the Appendix. This checklist must be completed during each inspection, dated, and signed by the Qualified Inspector conducting the inspection. Completed inspection checklist shall be kept on-site with the Contract Documents and submitted to the Engineer on a monthly basis. The Contractor will repair deficiencies within 24 hours of inspection.

3.09 MONITORING AND REPORTING

A. Monitoring: The Contractor shall be responsible for the implementation of the Inspections and Maintenance Procedures as included in the approved erosion and sediment control plan. The implementation must comply with guidelines as set forth in the SPDES General Permit as well as those of any local regulatory authorities. Minimum monitoring requirements are as follows:

1. A rain gauge shall be maintained in good working order on the site.

2. A written record of the daily rainfall amounts shall be retained. (Note: if no rainfall occurred the Contractor must record "zero").

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3. The control measures shall be inspected to ensure that they are operating correctly. Inspection records must be maintained for each inspection event and for each measure. All erosion and sedimentation control measures must be inspected by the Contractor at least once every seven calendar days and within 24 hours after any storm event of greater than ½ inch of rain per 24 hour period unless otherwise noted herein. Some measures require inspection following each rainfall event.

4. Once land disturbance has begun on the site, stormwater runoff discharge outfalls shall be inspected by observation for erosion, sedimentation and other stormwater discharge characteristics such as clarity, floating solids, and oil sheens. Inspections of the outfalls shall be made at least once every seven calendar days and within 24 hours after any storm event of greater than ½ inch of rain per 24 hour period. Inspection records must be maintained for each inspection event and for each discharge location.

5. If any visible sedimentation is leaving the site or entering waters of the State, corrective action shall be taken immediately to control the discharge of sediments.

B. Reporting: The Contractor shall prepare and submit a summary of the monitoring results to the Engineer, the Designer and the NYSDEC as required in the SPDES permit. The State reserves the right to use its own resources to duplicate monitoring and verify the work required by the Contractor in this section.

3.10 REMOVAL OF TEMPORARY SEDIMENT CONTROL STRUCTURES

A. At such time that temporary erosion and sediment control structures are no longer required under this item, the Contractor shall notify the Engineer of its intent and schedule for the removal of the temporary structures. The Contractor shall obtain the Engineer's approval in writing prior to removal. Once the Contractor has received such written approval from the Engineer, the Contractor shall remove, as approved, the temporary structures and all sediments accumulated at the removed structure shall be returned upgrade and stabilized so they do not re-erode. In areas where temporary control structures are removed, the site shall be left in a condition that will restore original drainage. Such areas shall be evenly graded and seeded as specified in Section 32 11 00 – Surface Restoration.

END OF SECTION

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SECTION 32 10 00
PAVING AND SURFACING

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish all labor, equipment and materials and perform all operations in connection with the construction of asphalt concrete pavement, asphalt concrete overlay, reinforced concrete pavement, gravel roads, concrete curb and gutter, repair and reconstruction of existing asphalt concrete pavement, repair of existing gravel roads, and pavement markings complete as specified herein and as detailed on the Drawings.

B. All new roads including the replacement of portions of the existing roads shall be to the limits, grades, thicknesses and types as shown on the Drawings. Patches for pipe crossings and areas damaged during the construction work shall be asphalt and/or gravel, depending upon the material encountered, unless otherwise indicated.

C. Related Sections:

1. Section 03 30 00 – Cast-In-Place Concrete

2. Section 31 00 01 – Earthwork

1.02 STANDARD SPECIFICATIONS

A. Except as otherwise provided in the Specifications or on the plans, all work shall be in accordance with the New York State Department of Transportation Standard Specifications for Roads and Structures except that any reference to “NYSDOT”, "Department" or "Unit" shall mean the "Owner". When reference to these Specifications is intended, the description will be NYSDOT Section _____ or NYSDOT Specifications.

B. Except with the approval of the Engineer, the placing of concrete or asphalt concrete surface paving shall be subject to the Seasonal and Weather Restrictions set forth in NYSDOT Specifications.

1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in Section 01 33 00 – Submittal Procedures, the Contractor shall submit the following:

1. Manufacturer’s plant design mixes shall bear the approval of NYSDOT’s Director, Materials Bureau. The written approvals shall not be older than one year from the date of proposed paving work of the Contract Documents.

2. A completed materials list showing all items to be furnished and installed under this Section.

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3. Certificates that materials, mixtures and products comply with Specification requirements signed by Contractor.

PART 2 – MATERIALS

2.01 GRANULAR FILL

A. The Contractor shall place Granular Fill as necessary to complete the embankments, shoulders, subgrade foundation and replacement for removed unsuitable material in accordance with NYSDOT Section 203, Select Fill and Section 31 00 01 – Earthwork.

2.02 CRUSHED STONE

A. All work, including materials, associated with Crushed Stone shall be in accordance with NYSDOT Section 203, Select Granular Fill and Section 31 00 01 – Earthwork.

2.03 SUBBASE COURSE

A. Subbase Course shall be a 12” layer in accordance with NYSDOT Item 733.0402, meeting the gradation requirements of Section 733-04, Table 733-04A, Type 2. Gradation shall be as follows:

U.S. Standard Sieve Size	Percent Finer by Weight
2 in.	100
1/4 in	25-60
No. 40	5-40
No. 200	0-10

2.04 ASPHALT BASE COURSE

A. Asphalt Base Course shall be a 4” thick layer in accordance with NYSDOT Item 404.257303. Use Coarse Aggregate meeting the requirements of Section 703-02 of the NYSDOT specifications.

2.05 ASPHALT BINDER COURSE

A. Asphalt Binder Course shall be a 2” thick layer in accordance with NYSDOT Item 404.197903. Use Coarse Aggregate meeting the requirements of Section 703-02 of the NYSDOT specifications.

B. The job mix formulas shall be delivered to the Engineer at least two (2) weeks prior to beginning paving operations.

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2.06 ASPHALT TOP COURSE

A. Asphalt Top Course shall be a 1" thick layer in accordance with NYSDOT Item 404.127303. Use Coarse Aggregate meeting the requirements of Section 703-02 of the NYSDOT specifications.

B. The job mix formulas (JMF) shall be delivered to the Engineer at least two (2) weeks prior to beginning paving operations. The JMF submitted for asphalt concrete pavement shall be dated to within 12 months of asphalt placement

2.07 REINFORCING MATERIALS

A. Welded Wire, Fabric: ASTM A185, sheet type only. Ensure that sheets are free from loose flaky rust, loose scale, oil, grease, mud, or other coatings that might reduce the bond with concrete.

B. Support for Reinforcement: Conform to recommendations by CRSI: Manual of standard practice.

2.08 CONCRETE CURB AND GUTTERS

A. Concrete shall be Class B in accordance with the requirements of Section 03 30 00 – Cast-In-Place Concrete, except that concrete shall be air-entrained to provide an air content of 6% ± 1.5%.

B. Premolded expansion joint filler for expansion joints shall conform to ASTM D 1751 and shall be 1/2-inch thick, minimum.

2.09 ASPHALT TACK COAT

A. Asphalt tack coat shall be in accordance with NYSDOT Section 407, Tack Coat and Section 702, Bituminous Materials, Material Designation 702-9000, Grade RS-1h.

PART 3 – EXECUTION

3.01 SUBGRADE

A. The subgrade, shown on the Drawings and determined by the Engineer, shall be treated in accordance with NYSDOT Section 203. The subgrade shall be formed true to crown and grade and shall be compacted with a minimum of four (4) passes of a 15 ton vibratory roller to conform to the maximum densities determined by AASHTO T99 Standard Specifications. In trenches or other areas that are difficult to access or maneuver, impactor rammers, plate or small drum vibrators or pneumatic buttonhead compaction equipment may be used, in accordance with NYSDOT Section 203.

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B. Hand excavate, shape and compact subgrade around utility poles, where clearances with existing pipes or structures are very small and along curbs, and along pavement edges.

C. If soft areas or areas with unsuitable material are encountered below excavation depth shown on drawings, perform additional excavation and fill with crushed stone. Do not place subbase or pipe bedding materials until all soft, muddy or irregular areas in the subgrade have been corrected.

3.02 SUBBASE COURSE

A. The finished subbase course of all paving shall be of the thickness shown on the Drawings, formed true to crown and grade. No fill material except new subbase shall be placed on top of existing gravel.

3.03 ASPHALT BASE COURSE

A. The Asphalt Base Course shall be placed and compacted in accordance with NYSDOT Section 402. Thicknesses shall be as shown on the Drawings, formed true to crown and grade.

3.04 ASPHALT BINDER COURSE

A. The Asphalt Binder Course shall be placed and compacted in accordance with NYSDOT Section 402. Thicknesses shall be as shown on the Drawings, formed true to crown and grade.

3.05 ASPHALT TOP COURSE

A. Prior to placement of the asphalt concrete top course, the base/binder course shall be inspected for damage or defects and repaired to the satisfaction of the Engineer. The surface of the base/binder course shall be approved by the Engineer.

B. The asphalt tack coat shall be applied to the surface of the approved Base or Binder course, existing pavement edges, castings, and concrete surfaces as described in NYSDOT Section 407. Contact surfaces of curbing, gutters, manholes and other similar structures shall be painted with a thin uniform coating of tack coat material just prior to the placing of the bituminous concrete mixture against them. All bituminous materials shall be cleaned from exposed surfaces of curbs, gutters, manholes and other similar structures. Equipment for applying the tack coat shall be power oriented pressure spraying or distributing equipment suitable for the materials to be applied and approved by the Engineer.

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3.06 ASPHALT CONCRETE PAVEMENT COMPACTION

A. Asphalt concrete pavement compaction shall be performed as per NYSDOT Sections 402-1 and 402-3, Hot Mix Asphalt Pavements for Utilities, Description and Construction Details. Thicknesses shall be as shown on the Drawings.

B. Contractor shall provide Quality Control (QC) for proper asphalt concrete pavement placement and compaction using equipment in good working order which has been properly calibrated at the start of each round of testing. Quality Assurance (QA) of paving operations will be performed by an independent third-party representative hired by Owner.

C. Immediately after the asphalt mixture has been spread, struck off and surface and edge irregularities adjusted, thoroughly and uniformly compact the pavement. Compact the mix to the required degree of compaction for the type of mixture being placed, as noted below in Table 1.

TABLE 1
SUPERPAVE DENSITY REQUIREMENTS

Superpave Mix Type	Minimum % Gmm (Maximum Specific Gravity)
SF9.5A	90.0
S9.5X, S12.5X, I19.0X, B25.0X	92.0

3.07 ASPHALT CONCRETE PAVEMENT PHASING

A. Contractor shall be responsible for phasing the placement of asphalt concrete pavement sections and courses to account for individual construction activities, the construction traffic volume, and vehicle loading expected throughout construction activities. The placement of asphalt concrete pavement shall also be phased so the aggregate base course, once installed, is not be exposed to freeze/thaw cycles.

3.08 ASPHALT CONCRETE DENSITY ACCEPTANCE

A. The Engineer will evaluate the asphalt pavement for density acceptance after the asphalt mix has been placed and compacted using the Contractor's QC test results, the Owner’s QA test results (including verification samples) and by observation of the Contractor's density QC process conducted in accordance with NYSDOT Standard Specifications, Section 402.

B. Minimum density requirements for all mixes will be as specified in Table 1. Density acceptance will be as provided herein. Core sample shall be obtained and tested by the Owner’s representative at the same frequency and location as the Contractor’s QC testing, if possible, and densities will be determined by use of the requirements as outlined in NYSDOT Standard Specifications, Section 402.

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C. A failing lot for density acceptance purposes is defined as a lot for which the average of all test sections, and portions thereof, fails to meet the minimum specification requirement. A lot will consist of one day's production of a given JMF, for each layer of asphalt concrete placed. If additional density sampling and testing, beyond the minimum requirement, is performed and additional test sections are thereby created, then all test results shall be included in the lot average.

D. Any lot or portion of a lot deemed obviously unacceptable by the Owner or Engineer will be rejected for use in the work. If the Engineer determines that a given lot of mix does not meet the minimum specification requirements, but the work is reasonably acceptable, the lot will be accepted at a reduced pay factor in accordance with the following formula. The reduced pay factor will apply only to the contractor's schedule of values.

1. $$\text{Reduced Pay Factor} = 100 + \left[\frac{(\text{Actual Density} - \text{Specified Density})}{2} \times 30\right]$$

a. Where:

1) Actual Density = the lot average density, not to exceed 2.0% of the specified density

2) Specified Density = the density in Table 3-1 or as specified in the Contract

3.09 CONCRETE CURB AND GUTTER

A. The expansion joint filler for concrete curb and gutters shall be cut to conform with the cross section of the curb. Expansion joints shall be spaced at intervals of not more than 25-feet. Formed control joints shall be installed at intervals not exceeding 10 feet. Depth of joint shall be 1/3 the thickness. Curved forms shall be used where radii are indicated; straight segments shall not be permitted. Upon removal of the forms, exposed curb faces shall be immediately rubbed down to a smooth and uniform surface. No plastering shall be permitted.

3.10 UNDERGROUND UTILITY LINES

A. Where an underground utility line is beneath the new roadway, the backfilling shall be carried out with special care, and the final consolidation shall be accomplished by a vibratory roller. Construction of the roadway over the trench shall be deferred as long as practicable.

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3.11 JUNCTION WITH OTHER PAVING

A. Where new asphalt concrete pavement abuts existing asphalt concrete pavement, the existing pavement shall be cut back to insure obtaining the specified compaction of the

new pavement courses and interlocking adjoining courses. Existing subbase courses shall be cut back from the subgrade level of the new pavement on a one-on-one slope into the existing pavement, and the asphalt courses of the existing pavement shall be removed for an additional 18 inches back from the slope. The edge of the existing asphalt courses shall be saw cut straight and true. The faces between new and existing asphalt courses shall receive an application of joint sealer.

B. Where new rigid concrete pavement abuts existing rigid concrete or asphalt concrete paving, the existing paving shall be saw cut straight and true. An expansion joint of a ½ inch minimum thickness with filler material and sealant shall be placed between the new concrete pavement and the existing rigid concrete or asphalt concrete paving.

C. Joints shall be sealed with hot-poured rubber asphalt before any traffic is permitted. The joint opening shall be cleaned of all extraneous matter. The contact faces of the joint shall be dry at the time of sealing. Compressed-air jets, power-driven wire brushes and any such additional equipment necessary to clean the joint and dry the contact faces shall be provided. The compound shall not be placed when the air temperature in the shade is less than 50 degrees F. The heating kettle in which the compound is prepared for pouring shall be of a type with indirect heating, the double boiler type, with built-in agitator and equipped with a thermometer to measure the temperature of the sealer. Direct heat will not be permitted.

D. Pouring of this compound for sealing the joints shall be done by the use of hand pots, mechanical methods or any other method which will give satisfactory results. Pouring shall be done in such a manner that the compound is not spilled on the exposed surface. Any excess compound on the surface shall be removed immediately.

E. Cover the sealer with fine sand or cement dust to prevent removal of the material by traffic.

3.12 ASPHALT CONCRETE OVERLAY

A. Where asphalt concrete is proposed to be placed over an existing asphalt or rigid concrete surface, the surfaces shall be thoroughly cleaned by power brooming and a tack coat shall be applied in accordance with the NYSDOT Standard Specifications for Roads and Structures, prior to installing the overlay. The overlay shall be applied in accordance with Articles 2.06 and 3.05 of this Section and Standard Details shown on the Drawings.

END OF SECTION

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SECTION 32 11 00
SURFACE RESTORATION

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Provide all labor, equipment, and materials necessary for final grading, topsoil placement, seeding, and miscellaneous site work not included under other Sections but required to complete the work as shown on the Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 00 01 – Earthwork

B. Section 31 25 00 – Erosion and Sedimentation Control

PART 2 – MATERIALS

2.01 TOPSOIL

A. Topsoil shall meet the requirements of Section 31 00 01 – Earthwork.

2.02 SEED MIXTURES

A. Temporary: Soil stockpiles and cleared and graded areas shall receive oat seed (*Avena sativa*) for temporary stabilization as required during the spring and summer months. Areas requiring temporary stabilization after August shall be seeded with certified Canada wild rye (*Elymus canadensis*).

B. Permanent: Seed mixtures shall be Lawn Mix (ERNMX-113) as manufactured by Ernst Seed Co. or approved equal. Seed mixes shall be applied at a rate of 100 lbs/acre.

1. Nurse/Cover seed for the permanent seed mixture shall consist of oats (*Avena sativa*) during spring seeding season and certified Canada wild rye (*Elymus canadensis*) during fall seeding season. Nurse/cover seed shall be added to the permanent seed mix at a rate of 10 lbs per acre or 0.23 lbs per 1,000 sq. ft.

PART 3 – EXECUTION

3.01 INSTALLATION REQUIREMENTS

A. The Contractor shall take all necessary measurements in the field to determine the exact dimensions for all work and verify all pertinent data and dimensions shown on the Contract Drawings.

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B. Perform actual planting when conditions are suitable within the timeframes per vegetation type. No plant material shall be planted when the ground is frozen or in excessively moist condition. Notify the Engineer before proceeding with any planting operations.

C. The Contractor shall proceed with and complete landscape work as rapidly as portions of site become available, working within seasonal limitations for each kind of landscape work required.

D. Utilities. The Contractor shall determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is approved by the Engineer.

E. Excavation. When conditions detrimental to plant growth are encountered, such as rubble fill, adverse draining conditions, or obstructions, notify the Engineer.

3.02 FINAL GRADING

A. Following approval of rough grading the subgrade shall be prepared as follows:

1. For riprap, bare soil 24 inches below finish grade or as directed by Engineer.

2. For topsoil, scarify 2-inches deep at 4 inches below finish grade.

3.03 TOPSOIL PLACEMENT

A. Topsoil shall be placed over all areas disturbed during construction under any contract except those areas which will be paved, graveled or rip rapped.

B. Topsoil shall be spread in place for lawn and road shoulder seed areas at a 4-inch consolidated depth and at a sufficient quantity for plant beds and backfill for shrubs and trees.

C. Topsoil shall not be placed in a frozen or muddy condition.

D. Final surface shall be hand or mechanically raked to an even finished surface to finish grade as shown on Drawings.

E. All stones, roots over 4-inches, rubbish, and other deleterious materials shall be removed and disposed of.

3.04 TEMPORARY SEED MIXTURE

A. A temporary seed mixture shall be used to stabilize stockpiles and portions of the site where construction activities have temporarily or permanently ceased not more than 7 days after the construction activity in that portion of the site has temporarily or

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permanently ceased. This requirement does not apply if earth-disturbing activities will be resumed within fourteen (14) days.

B. Seed mixture – Temporary seeding shall be oat seed (Avena sativa) at a rate of 30 lbs per acre of 0.7 lbs per 1,000 sq. ft. If area is seeded during months of September through November, certified Canada wild rye (Elymus canadensis) shall be used at a rate of 50 lbs per acre or 1.25 lbs per 1,000 sq. ft.

C. If temporary seeding is not made within 24 hours of construction/disturbance the soil must be scarified prior to seeding.

D. Method of seeding – seed shall be evenly applied with broadcast seeder, drill or cultipack seeder.

E. If temporary seeding is made under favorable soil and site conditions during the optimum seeding dates (March 15 – May 15 or September 1 – October 15) mulch is not required. Terra-tack, as manufactured by Reinco, Inc., Hydrobond by JRM Chemical, Inc, Dustout by DustoutUS, or equivalent as approved by the engineer, shall be used. Temporary seeded area can be mulched with a straw of oat or wheat stalks (not hay) applied at a rate of 2 tons per acre (100 - 200 bales / acre) uniformly distributed over the sown seeds and held in place through the use of a straw crimper.

F. Any area with fail to establish vegetative cover adequate to prevent rill erosion will be reseeded as soon as such areas are identified.

3.05 PERMANENT SEED MIXTURE

A. Seed materials shall be inspected by the Engineer upon arrival at the job site and prior to planting. Any materials not in compliance with specifications shall not be accepted and shall be removed from the job site immediately.

B. All seed materials shall be protected from drying out and from wind damage during delivery.

C. All areas shown to receive seed on Contract Drawings and all areas which are disturbed and not planted shall be seeded.

D. Seedbed Preparation – Scarify all compacted areas and remove all debris and obstacles such as rocks and stumps.

E. Do not broadcast seed by mechanical application when the wind velocity is such as to prevent uniform seed distribution.

F. Time of Seeding – Permanent seeding shall be done within 15 days of final construction activities. Optimum seeding times are in the Spring from March 15 – May 15 and in Fall from September 1 – October 15. If construction is completed during mid-summer, seeding may be done if watering will be provided.

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G. Method of Seeding – Seed shall be evenly applied with a broadcast seeder, drill or multipack seeder.

H. Following the seeding operation, 10-10-10 fast release fertilizer shall be broadcast at a rate of 400 lbs/acre throughout the seeded area by hand or mechanically using a cyclone broadcaster. Seed shall be watered as recommended by the seed manufacturer to achieve specified growth coverage.

I. All seeded areas and areas with slopes of 3:1 or steeper, areas shall be covered with anchored stabilization matting in accordance with Section 31 25 00 – Erosion and Sedimentation Control.

J. Seeding shall be deemed acceptable when 85% coverage of the seeded area with the seeded species has been achieved. Any area not meeting this requirement shall be reseeded with the original seed mix.

K. Areas seeded with temporary cover grass shall be rototilled and/or harrowed prior to seeding with permanent seed mix during the allowed time period.

3.06 CLEANUP

A. The Contractor shall remove from the site all subsoil excavated and all other materials, supplies, equipment which the Contractor or any Subcontractors may have used in the performance of the work, and debris including, but not limited to, branches, paper, and rubbish in all landscape areas, and remove temporary barricades as the work proceeds. The Contractor shall broom clean paved surfaces.

B. The Contractor shall thoroughly clean all materials, equipment and structures installed under this Contract; all marred surfaces shall be touched up to match adjacent surfaces.

C. The Contractor shall clean all landscaped areas of all debris and any objectionable material, as determined by the Engineer, and shall remove all such debris off-site.

D. All areas shall be kept in a neat, orderly condition at all times. Prior to final acceptance, the Contractor shall clean up the entire landscaped area to the satisfaction of the Engineer. The Contractor shall also cut all perimeter grass and weeds before final acceptance.

END OF SECTION

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SECTION 32 31 13

STEEL FENCING

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install steel fencing, posts, gates, etc., where shown on the Drawings and in compliance with these Specifications.

B. Fencing shall be of the chain link type topped with barbed wire. The 6-foot high fabric shall clear the final grade by 3 inches and shall be topped with three strands of barbed wire. The barbed wire shall be angled outward at the top. All components which are to be galvanized shall be hot dipped galvanized, coating to be 1.8 ounces per square foot of surface. Alternate coatings which employ a zinc coating of less than 1.8 ounces per square foot are not acceptable.

C. Related Sections:

1. Section 03 30 00 – Cast-in-Place Concrete

2. Section 08 71 00 – Finish Hardware

1.02 SUBMITTALS

A. Shop Drawings shall be furnished in accordance with Section 01 33 00 – Submittal Procedures.

PART 2 – PRODUCTS

2.01 CHAIN LINK FABRIC

A. Fabric shall be 9-gauge aluminum coated wire woven in a 2-inch diamond mesh conforming to ASTM A491. Top and bottom selvage to have a barbed finish. Minimum weight of coating shall be 0.40 ounce per square foot of wire surface. The coated wire shall have a minimum tensile strength of 80,000 lbs. per square inch.

B. Install fabric 3 inches above ground level. Fence shall be stretched tight and securely fastened to posts at points spaced 12 inches apart maximum.

2.02 POSTS

A. Posts and rails shall be galvanized standard weight pipe conforming to the requirements of ASTM F1083.

1. Line Posts: Line posts shall be Schedule 40, 2-7/8-inch O.D. galvanized pipe with minimum bending strength of 201 pounds under a 6-foot cantilever load. Line posts shall be spaced at a maximum 10-foot O.C.

2. Terminal Posts: All end, corner, intermediate, and pull posts and gate leaves 6'0" wide and less shall be 3-½ inch O.D. galvanized Schedule 40 pipe with minimum bending strength of 381 pounds on 6-foot cantilever load. Gate posts for gate leaves shall be Schedule 40 pipe complying with ASTM F1083 of diameters as follows:

Gate Leaf Width	Pipe O.D.	Weight per Ft.
0' to 6'	3-1/2"	9.11 lbs.
Over 6' to 13'	4"	10.79 lbs.
Over 13' to 18'	6-5/8"	18.97 lbs.
Over 18'	8-5/8"	24.7 lbs.

2.03 TENSION WIRE

A. Top and bottom tension wire shall be No. 7 gauge aluminum coated steel wire. Fabric shall be securely tied to tension wire at intervals not to exceed 24-inches.

2.04 POST TOPS AND BARBED WIRE SUPPORTS

A. Gate, end, corner and line post tops shall be malleable iron or pressed steel and shall be hot dipped galvanized conforming to ASTM A153.

B. Extension arms for supporting the three (3) strands of barbed wire for line posts shall be of pressed steel with malleable iron base, or solid aluminum alloy castings.

C. Angles for line post extension arms shall be approximately 45 degrees from the vertical and the top slot for barbed wire shall be a minimum of 12 inches above the fabric and a minimum of 10 inches from the fence line.

2.05 BARBED WIRE

A. Barbed wire shall consist of three strands of 12-1/2-gauge aluminum coated steel wire with 4-point barbs of 14 gauge aluminum wire spaced 5 inches apart, conforming to ASTM A585.

B. Additional strands of barbed wire shall be added beneath the chain link fabric at all ditch crossings to maintain the security of the fence installation.

2.06 BRACES AND TOP RAILS

A. Braces and top rails (where shown on the Drawings) shall be 1.66-inch O.D., Schedule 40 galvanized pipe with minimum vertical bending strength of 202 pounds on 10-foot span.

B. Top rails shall be continuous and shall pass through the post tops. The coupling used to join the top rail lengths shall allow for expansion. Brace rails shall be provided at all terminal posts, located between the top and grade lines and extend from the terminal post to the first adjacent post. Braces shall be securely fastened at both ends. Brace ends for receiving brace rails shall be malleable iron or castings of 356.0 (formerly SG70A) alloy, or equivalent of ASTM B26 or B108.

C. Truss and stretcher bands shall be 1/8-inch x 7/8-inch pressed steel, supplied with carriage bolts and nuts. Bolts shall be 5/16-inch by 1 1/4-inch. Truss rods shall be 3/8-inch nominal diameter.

2.07 FABRIC TIES

A. Wire ties shall be pre-formed 0.148-inch diameter (9 gauge) aluminum. Flat band type ties shall be 1100-H18 or 3003-H14, .064-inch thick by 1/2-inch wide.

B. Hog rings for attaching tension wire to fabric shall be 0.105-inch diameter, Alloy 1100-H14.

2.08 GATES

A. Gate frames shall be made of 2-inch O.D. ASTM F1083 pipe, 2.72 lbs. per foot hot dipped galvanized. Fabric shall match fence. Gate frames shall be welded or assembled with riveted corner castings. Gate frames shall be equipped with 3/8-inch diameter adjustable truss bars. Hinges shall be ball and socket.

B. Gate shall be equipped with positive latching device with provision for padlocking. Personnel gates shall be minimum 36-inch clear opening.

PART 3 – EXECUTION

3.01 INSTALLATION

A. All line posts shall be spaced equidistant in the fence line on a maximum of 10-foot centers. Posts shall be set plumb in concrete bases as detailed on Drawings. The top of the posts shall be brought to a smooth grade line. The wire fence shall be set accurately to line and grade and shall be plumb.

B. End, corner, pull or intermediate posts shall be placed in the following locations: corners; changes in direction; abrupt changes in grade; intervals no greater than 500 feet in the fence line. Each end or gate post shall have one brace assembly and each corner or intermediate post shall have two brace assemblies.

C. Horizontal braces shall be provided at all terminal posts, corner posts, and intermediate posts between top rail and ground and shall extend from the above-mentioned posts to the first adjacent line posts. Braces shall be securely fastened to the line posts by brace ends and brace bands and to the terminal posts by approved rail end connectors. Diagonal brace rods shall be trussed from the brace end on the line post back to the terminal post, corner post or intermediate post and fastened to it by an approved connector.

3.02 POST FOUNDATIONS

A. Post holes shall be in true alignment and of sufficient size to provide a permanent foundation of concrete. Holes shall be well centered on the posts. A minimum diameter of 12 inches shall be required for all posts.

B. Post foundations shall be carefully rodded or tamped into place. The top of concrete shall extend 2 inches above ground line and shall be neatly troweled and leveled up from edges to the posts so as to have a pitch outward in all directions.

C. No materials shall be installed on the posts, nor shall any load be applied to the posts within 3 days after the individual post foundation is completed.

D. All concrete shall be Class "B" in conformance with Section 03 30 00 – Cast-in-Place Concrete.

3.03 RESETTING OF EXISTING FENCE

A. Where shown on the Drawings that resetting of existing fence is required, the fence, after resetting, shall be in a condition that is equal to or better than before the fence was removed.

B. The Contractor shall replace any of the fence components which have been unnecessarily damaged by him.

3.04 PADLOCK AND KEYS

A. One solid brass padlock shall be furnished with each gate. Padlocks shall be master keyed to the system specified under Section 08 71 00 – Finish Hardware.

3.05 TEMPORARY FENCING

A. The Contractor shall furnish and install all temporary fencing and appurtenances as shown on the Drawings or as required during construction to adequately secure the site prior to installation of the permanent fence.

END OF SECTION

SECTION 33 24 00

STORM DRAINS AND ROOF DRAINS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Furnish all labor, equipment and materials in connection with the installation of exterior underground Storm drains and Roof drains as shown on the Contract Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 00 01 – Earthwork

B. Section 31 23 19 – Dewatering

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. ASTM C 76 – Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

B. ASTM C 150 – Standard Specification for Portland Cement.

C. ASTM C 443 – Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

D. ASTM C478 –Standard Specification for Precast Reinforced Concrete Manhole Sections

E. ASTM C857 – Minimum Structural Design Loading for Underground Precast Concrete Utility Structures

F. ASTM C969 – Standard Practices for Infiltration and Exfiltration Testing of Installed Precast Concrete Pipe Sewer Lines

G. ASTM C990 – Standard Specification for Joints in Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

H. ASTM C1103 – Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines

I. ASTM C1619 – Standard Specifications for Elastomeric Seals for Joining Concrete Structures

J. ASTM C1628 – Standard Specifications for Joints for Concrete Gravity Flow Sewer Pipe, Using Rubber Gaskets

K. ASTM D 2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and other Gravity-Flow Applications.

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L. ASTM D 3350 – Standard Specifications for Polyethylene Plastic Pipe and Fitting Material.

M. AWWA C 110 – Standard Specification for Ductile Iron Pipe & Fittings for Water and Other Liquids.

N. AWWA C 151 – American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.

O. AASHTO M 198 – Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

P. AASHTO M 294 – Standard Specifications for Corrugated Polyethylene Pipe (12” to 36”).

Q. AASHTO Section 30 – Thermoplastic Pipe.

1.04 SUBMITTALS

A. Furnish and submit shop drawings and certificates for the piping work as outlined in the Section 01 33 00 – Submittal Procedures.

B. Special care shall be exercised during delivery, distribution and storage of the pipe and fittings to prevent damage. Damaged pipe will be rejected and shall be replaced at the Contractor's expense. Storage of pipe and fittings, prior to use, shall be in such a manner as to keep the materials clean and dry.

PART 2 – PRODUCTS

2.01 REINFORCED CONCRETE PIPE (RCP) – STORM DRAINS AND CULVERTS

A. Pipe and Joints

1. Reinforced concrete pipe for storm drains and culverts shall conform to ASTM Standard C76, Class III, Wall thickness B, unless otherwise noted on the Contract Drawings. Elliptical reinforcement will not be permitted. All pipe shall be aged at the manufacturing plant for at least fourteen (14) days before delivery to the job site. All pipe shall be of the sizes indicated on the drawings

2. Joints for the reinforced concrete culvert and storm drain pipe shall have bell and spigot ends with preformed flexible joint sealants meeting the requirements of ASTM C 990.

B. Gaskets

1. Gaskets shall be leak-resistant with elastomeric seals (gaskets) made of natural rubber, synthetic rubber, or a blend of both meeting the physical requirements prescribed in Specification ASTM 1619-19 for Class A, C, or E gaskets.

C. Joint Lubricant

1. Joint lubricant shall be of the type recommended by the manufacturer. Use of petroleum based lubricants is not permitted.

2.02 DUCTILE IRON PIPE (DIP) ROOF DRAINS AND PVC ROOF DRAINS

A. Pipe

1. DIP shall be manufactured in accordance with ANSI A21.10 (AWWA C110).

2. Schedule 80 PVC shall be manufactured in accordance with ASTM D2467.

3. DIP shall be manufactured of grade 70 50 05 ductile iron.

4. Shall have a rated working pressure of 250 psi.

5. Grey iron fittings which conform to the specifications contained herein may be used with ductile iron pipe providing the piping systems minimum working pressure is met or exceeded, and only where ductile iron fittings are not manufactured for a specific fitting.

B. Fittings

1. Shall be manufactured in accordance with ANSI A21.10 (AWWA C110).

2. Shall be manufactured of grade 70-50-05 ductile iron.

3. Shall have a rated working pressure of 250 psi.

4. Grey iron fittings which conform to the specifications contained herein may be used with ductile iron pipe providing the piping systems minimum working pressure is met or exceeded, and only where ductile iron fittings are not manufactured for a specific fitting.

C. Coatings and Linings for Pipe and Fittings

1. The standard asphaltic coating shall be applied to the exterior wall of the pipe and fittings in accordance with ANSI A21.51 (AWWA C151).

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2. The pipe and fittings shall be cement mortar lined to twice the standard thickness in accordance with ANSI A21.4 (AWWA C104) except as specified in the pipe schedule. A seal coat of asphaltic material shall be applied to the mortar lining.

D. Joints

1. Joints shall be push on type in accordance with ANSI A21.11 (AWWA CIII).

2. Joints shall be solvent weld type in accordance with ASTM D1785 and/or ASTM D2665 for Schedule 80 PVC pipe

2.03 SMOOTH LINED CORRUGATED HIGH-DENSITY POLYETHYLENE (HDPE) PIPE - STORM DRAINS AND CULVERTS

A. General

1. Smooth lined corrugated high-density polyethylene (HDPE) pipe shall be used for storm drains and shall be BLUE SEAL watertight HDPE pipe as manufactured by Hancor, Inc., N-12 WT IB (Watertight) Pipe by ADS, Inc., or approved equal.

B. Pipe and Fittings

1. Smooth lined corrugated HDPE pipe and fittings shall conform to AASHTO M252-TYPE S for 4" to 10"φ and AASHTO M294 - TYPE S for 12" to 36"φ. All pipes shall be of the sizes indicated on the drawings.

C. Joints

1. Joints shall be watertight bell and spigot type; Hancor, Inc. BLUE SEAL, ADS, Inc. N-12 WT IB, or approved equal.

D. Foundation Drains

1. Foundation drains shall conform to AASHTO M252-TYPE C. Drains shall have drilled perforations and be Heavy Duty-AASHTO Pipe as manufactured by Hancor, Inc., Single Wall Corrugate Pipe by ADS, Inc., or approved equal.

2.04 BACKFILL MATERIAL

A. The material obtained from excavation of the pipe trench or elsewhere on site with a particle size not greater than 3 inches shall be used for pipe backfill if they conform with the soil classes given in Table 1. Imported materials meeting the criteria of Table 1 may also be used.

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Table 1: Acceptable Backfill Material and Compaction Requirements

Soil Classifications				
Description	**ASTM D 1479**	**ASTM D 2487**	**AASHTO M 43**	**Minimum Standard Proctor Density %**
Graded or crushed, crushed stone, gravel	Class I	--	5 56	Dumped
Well-graded sand, gravels and gravel/sand mixtures, poorly graded sand, gravels and gravel/sand mixtures; little or no fines	Class II	GW GP SW SP	57 6	95%
Silty or clayey gravels, gravel/sand/silt or gravel and clay mixtures; silty or clayey sands, sand/clay or sand/silt mixtures	Class III	GM GC SM SC	Gravel and Sand (<10% fines)	95%

PART 3 – EXECUTION

3.01 INSPECTION

A. Each length of pipe and fittings delivered to the property shall be inspected by the Contractor, in the presence of the Engineer, for flaws, cracks, dimensional tolerances and compliance with the referenced Standards. The Contractor shall provide the Engineer with suitable templates or calipers for checking pipe dimensions. Only lengths of pipe and fittings accepted by the Engineer and so marked may be installed in the work.

3.02 INSTALLATION

A. Trenching, bedding and backfilling shall be as specified in Section 31 00 01 – Earthwork of these Specifications and Article 2.04 of this Section. Under no condition shall pipe be laid in water or when trench conditions or weather are unsuitable for such work.

B. All pipes and fittings shall be handled carefully in loading and unloading. They shall be lifted by hoists or lowered on skidways in such a manner as to avoid shock. Derricks, ropes or other suitable equipment shall be used for lowering the pipe into the trench. Pipe and fittings shall not be dropped or dumped.

C. Each pipe and fitting shall be inspected before it is lowered into the trench. The interior of the pipe and all joint surfaces shall be thoroughly cleaned and shall thereafter be maintained clean. The open ends of pipe shall be securely plugged whenever pipe laying is not in progress.

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D. Pipe and fittings shall be selected so that there will be as small a deviation as possible at the joints and so that inverts present a smooth surface. All joints shall be installed, made

up and inspected in accordance with approved printed instructions of the manufacturer. Pipe and fittings which do not fit together to form a tight joint will be rejected.

E. Cutting of reinforced concrete pipe will be permitted only at connections to structures and be accomplished by abrasive saws. Cutting of other pipe materials shall be done only with mechanical cutters and in accordance with the manufacturer's recommendations.

F. Pipe shall be laid accurately to the lines and grades shown on the drawings or as directed by the Engineer.

G. If an adequate foundation for the pipe is not available at the desired depth, additional excavation shall be required, and the foundation brought to desired grade with suitable granular material.

H. Rock outcroppings, very soft soils such as muck, and other similar materials not providing proper foundation support shall be removed/replaced with suitable granular material.

I. Bedding material directly under the pipe invert shall be left in native condition and not compacted. Pipe shall be placed on the bedding, then backfilled under the pipe haunches before further backfill is placed.

J. Class I materials may be dumped around pipe. Voids shall be eliminated by knifing under and around the pipe or by other approved technique.

K. Inorganic silts, gravelly, sandy, or silty clays, and other Class IV materials (not shown in Table 1) shall not be used for pipe backfill.

L. Any section of the pipe that is found defective in material, alignment, grade, joints, or otherwise, shall be satisfactorily corrected by the Contractor at no additional cost to the Owner.

M. The HDPE storm drainpipe/culvert manufacturer/ supplier shall be required to have a qualified representative on site at the start of HDPE pipe installation. The contractor shall submit work experience documentation for the representative for review/ approval by the engineer or designated representative. The representative shall be available for consultation as needed throughout the HDPE storm drainpipe/ culvert installation for the project.

3.03 COMPACTION

A. General

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1. Place and assure backfill and fill materials achieve an equal or higher degree of compaction than undisturbed materials adjacent to the work.

2. In no case shall degree of compaction below “Minimum Compactions” specified be accepted.

B. Compaction Requirements: Unless noted otherwise on the Drawings or more stringently by other Sections of these Specifications, comply with following trench compaction criteria:

Table 2: Minimum Compactions

Location	Soil Type	Density
Compacted Select Backfill		
All applicable areas	Cohesive soil	95 percent of maximum dry density by ASTM D698
	Cohensionless soils	75 percent of maximum relative density by ASTM D4253 and ASTM D4254
Common Trench Backfill		
Under pavements roadways surfaces, D698 within highway rights-of-way, adjacent to retaining walls	Cohesive soils	95 percent of maximum dry density by ASTM D698
	Cohensionless soils	75 percent of maximum relative density by ASTM D4253 and ASTM D4254
Under turfed, sodded plant seeded, non-traffic areas	Cohesive soils	95 percent of maximum dry density by ASTM D698
	Cohensionless soils	75 percent of maximum relative density by ASTM D4253 and ASTM D4254

C. Ensure backfill materials have moisture content within three (3) percent of optimum moisture content at the time of placement.

3.04 INSPECTION AND TESTING

A. General

1. The Contractor shall provide at his own expense, all labor, material, video and measuring devices, water, plugs, or other equipment necessary to perform the required tests. All tests shall be performed in the presence of the Engineer. Disposal of water shall be in accordance with the requirements included in Section 31 23 19 – Dewatering.

B. Tests by Manufacturer

1. Reinforced Concrete Storm Drains and Culverts - An infiltration and exfiltration test for the pipe shall be made at the place of manufacture. Certified test results shall be submitted. The infiltration or exfiltration allowance shall not exceed the limits as set in the “Performance requirements for Joints” paragraph in ASTM C443 – 12 (2017) or ASTM C990-09 (2014), depending on the type of gasket specified.

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1. DIP, PVC, and HDPE - An infiltration and exfiltration test for the pipe shall be made at the place of manufacture. Certified test results shall be submitted. The infiltration or exfiltration allowance shall not exceed 250 gallons per inch of pipe diameter per mile per day. One joint test for each two hundred feet of pipe to be furnished.

C. Field Test - Visual Inspection

1. Examine structures and pipes for:

   a. Physical damage.

   b. Indication of displacement of pipes or structures, reinforcement, forms, or bedding.

   c. Porous areas or voids.

   d. Proper placement of seals, gaskets, and embedments.

   e. Visible infiltration.

2. Verify structures and pipes are set to proper line, grade as per the Contract Drawings, and are plumb.

3. Verify structure and pipe dimensions and thickness match Contract Drawings.

4. Measure inside dimensions of all flexible (HDPE) pipe prior to installation. Use these dimensions when sizing the mandrel should deflection testing be required.

   a. Using light to inspect pipe shall be done following pipe trench backfill is compacted and brought to grade or pavement subgrade.

   b. Full pipe diameter shall be visible for entire length of each section between structures.

   c. No less than half pipe diameter shall be visible for horizontal alignment.

5. The Contractor shall be responsible to provide video recording of the all installed storm sewer systems at least 30 days after completion of backfill and one month before Owner or Engineer gives final acceptance for the two-year warranty. The recording shall be made using a color camera, self-propelled or other, having sufficient light to show detail of problem areas and joints. Camera speed shall not exceed 3 feet per second. If problems or concerns are seen by the operator, then the camera shall be reversed and an extended look at the area will be recorded. All recordings will have time, date, and footage displayed. Supplement the video recording with a written log or orally recorded tape log noting observations, findings, and deficiencies shown on the video tape.

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a. The video recording inspection shall be performed by an outside independent testing agency acceptable to the Owner or Engineer.

b. The video tape and log will be given to the Engineer for review. If the Engineer finds any problems with the storm sewer, the Contractor will repair the problem and re-camera the repaired area before final acceptance will be given, at no added cost to the Owner.

c. Video recording of storm sewer may be waived if pipe diameter is sufficient for human access, as determined by the Engineer. A log shall be developed for such inspection.

d. One copy of the video tape and log will become permanent property of the Engineer and Owner as record.

D. Field Test - Storm Drains and Culverts less than 30” Ø

1. If, after the visual inspection and video recording of the storm trunk or lateral lines, the Engineer finds there is a potential joint tightness problem, or excessive deflection, and the Contractor does not agree to repairing defects in pipe based on visual inspection, he/she may require leakage testing of the line.

a. Reference ASTM C696, latest revision. Test shall be used if the groundwater level is less than 2 ft. above the crown of the pipe measured from the highest elevation of the pipe length being tested.

b. Leakage rate testing applies to only circular pipe less than 30” Ø. The length of pipe tested shall not exceed 700 ft.

c. The leakage testing shall occur at least 30 days after completion of the backfilling and compaction.

d. If the Engineer determines reliable and uniform results are produced by the Contractor's construction techniques, the leakage testing may occur after initial backfill and compaction.

2. The Contractor shall provide all equipment and personnel to perform the leakage testing.

3. The Engineer shall record times and calculation leakage rates during the test period.

4. The leakage test shall be performed as follows:

a. Plug all pipe outlets discharging into the upstream manhole and the test section outlet. Fill the sewer line with water.

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b. At the upstream manhole the test head shall be established as minimum of 2 ft above the crown of the pipe, or at least 2 ft above existing groundwater, whichever is higher.

c. Allow the pipe to remain saturated for a period long enough to allow water absorption in the pipe, a minimum of 4 hours and up to a maximum of 72 hours. After the absorption period, refill the pipe to the required test head.

d. Measure the leakage loss over a timed test period. The minimum test period shall be 15 minutes and the maximum shall not exceed 24 hours.

5. The allowable leakage limit including manholes is 250 gal/(in. of internal diameter) (mile of sewer) (24 h) when the average head on the test section is 6 ft or less.

6. When the average head on the test section is greater than 6 ft, the allowable leakage shall be multiplied by the ratio of the square root of the average test head and the square root of the base head of 6 ft.

7. Manholes shall be tested separately and independently or with the pipeline with an allowance of 0.1 gal/(ft of diameter) (ft of head) (h).

8. Sections of the pipe which fail the air test, shall have the defects repaired, and the test shall be repeated.

a. The initial leakage testing, repair, and repeat testing of the failed section of pipe shall be repeated at no added cost to the Owner until the testing requirements are met.

E. Field Test - Storm Drains and Culverts 30” Ø and greater

1. If, after the visual inspection and video recording of the storm trunk or lateral lines, the Engineer finds there is a potential joint tightness problem, or excessive deflection, and the Contractor does not agree to repairing defects in pipe based on visual inspection, he/she may require air or water pressure testing of individual pipe joints.

a. Reference ASTM C1103, latest revision. The following procedures apply to testing with either air or water.

b. Pressure testing applies to only circular pipe 30” Ø or greater and not elliptical, arch or box sections.

c. The pressure test shall occur at least 30 days after completion of the backfilling and compaction.

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d. If the Engineer determines reliable and uniform results are produced by the Contractor's construction techniques, the pressure test may occur after initial backfill and compaction.

2. The Contractor shall provide all equipment and personnel to perform the pressure testing.

3. The Engineer shall record times and observe pressure losses during the test period.

4. If the groundwater pressure is equal to or greater than the test pressure, and the storm drain or joint is not leaking, the storm drain or joint is acceptable in accordance with ASTM C969 and no additional testing is required. If one or more joints are leaking, but the total amount of leakage in the storm drain being tested is equal to, or less than, the allowable leakage rate established in accordance with ASTM C969, the line is acceptable and no additional testing is required provided visible leaks are repaired. Moisture or beads of water appearing on the surface of the joint will not be considered as visible leakage.

5. The pressure test shall be performed as follows:

   a. Move the joint test apparatus into the sewer line to the joint to be tested and position it over the joint. The end element sealing tubes must straddle both sides of the joint and the hoses are attached. For the water test, the bleed-off petcock must be located at top dead center.

   b. Inflate end element sealing tubes with air or water in accordance with equipment and manufacturer's instructions.

   c. All test pressures are measured as gauge pressure, defined as any pressure greater than atmospheric pressure. Test observer shall note water produces a pressure of 0.43 psi for every foot of depth, and therefore test pressures must be increased to offset the depth of groundwater over the sewer line. If the groundwater level is 2 ft or more above the top of the pipe at the upstream end or if the pressure required for the test is greater than 6-psi gauge, the joint test method shall not be used and the infiltration test may be used (see ASTM C969).

   d. An air or water reservoir shall be included in the joint test system. By maintaining a constant supply of air or water in a reservoir, continuous pumping of air or water is not required, and any variances in test equipment and joint space will be negated. The reservoir shall have a minimum volume of 2.5 ft^3.

6. The joint air pressure test shall be performed as follows

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a. Pressurize the void volume with air to 3.5 psi greater than the pressure exerted by groundwater above the pipe. Allow the air pressure and temperature to stabilize before shutting off the air supply and start of test timing.

b. If pressure holds, or drops less than 1 psi in 5 seconds, the joint is acceptable.

c. If the joint being tested fails, it shall be retested, or repaired if necessary, and retested.

d. After the joint test is completed, exhaust void volume, then exhaust end element tubes prior to removal of apparatus.

7. The joint water pressure test shall be performed as follows

a. Introduce water into void volume until water flows evenly from open petcock. Close the petcock and pressurize with water to 3.5 psi above the pressure exerted by groundwater above the pipe. Shut off the water supply.

b. If pressure holds, or drops less than 1 psi in 5 seconds, the joint is acceptable.

c. If the joint being tested fails, it shall be retested, or repaired if necessary, and retested.

d. After the joint test is completed, exhaust end element tubes which will automatically release the water from the void volume, prior to removal of apparatus.

F. Deflection Test – Flexible Pipe

1. If after the visual or video inspection of the storm trunk or lateral lines, the Inspector finds there is “egging or deflection” of a section of pipe, a deflection test shall be performed on the defective section of pipe installed. Test shall be performed using an odd-legged mandrel pulled through the pipe without mechanical assistance or by laser profiling. The mandrel size shall be the measured inside diameter of the subject pipe minus 5% of the measured diameter. The mandrel shall have no less than nine legs.

2. Any pipe failing any deflection test shall be removed, replaced, and retested.

3. At the end of the two-year warranty period, the flexible storm pipe will be visually inspected for “egging or deflection”. If excess deflection is observed, the Owner/Warranty Holder will, at his/her expense, retest questionable portions per this section.

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G. Repair

1. Repair or replace any unacceptable work at no additional cost to the Owner.

2. Repair all visible leaks.

3. Remove any concrete webs or protrusions.

4. Remove form ties and repair tie holes.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 40 05 00
BASIC MECHANICAL REQUIREMENTS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install to the required line and grade, all piping together with all fittings and appurtenances, required for a complete installation. Piping to be backfilled and/or encased in concrete is considered to be buried piping. Piping that is not buried is considered to be exposed.

B. The Contractor shall furnish and install fittings, connections, sleeves, adapters, harness rods and closure pieces as required to connect pipelines of dissimilar materials and/or sizes herein included under this Section and other concurrent Contracts for a complete installation.

C. The Contractor shall furnish all labor, materials, equipment, tools, and services required for the furnishing, installation and testing of all piping as shown on the Drawings, specified in this Section and required for the Work. Piping shall be furnished and installed of the material, sizes, classes, and at the locations shown on the Drawings and/or designated in this Section. Piping shall include all fittings, adapter pieces, couplings, closure pieces, harnessing rods, hardware, bolts, gaskets, wall sleeves, wall pipes, hangers, supports, and other associated appurtenances for required connections to equipment, valves, or structures for a complete installation.

D. Piping assemblies under 4-inch size shall be generally supported on walls and ceilings, unless otherwise shown on the Drawings or ordered by the Engineer, being kept clear of openings and positioned above "headroom" space. Where practical, such piping shall be run in neat clusters, plumb and level along walls, and parallel to overhead beams.

E. The work shall include, but not be limited to, the following:

1. Connections to existing pipelines.

2. Installation of all new pipe and materials required for a complete installation.

3. Cleaning, testing, and disinfecting as required.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Division 02 – Existing Conditions

B. Division 05 – Metals

C. Section 09 90 00 – Painting.

D. Division 26 – Electrical

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E. Section 40 05 97 – Piping and Equipment Identification Systems

F. Section 40 06 20 – Process Pipe, Valve, and Gate Schedules

G. Division 46 – Water and Wastewater Equipment

1.03 MATERIAL CERTIFICATION AND SHOP DRAWINGS

A. The Contractor shall furnish to the Owner (through the Engineer) a Material Certification stating that the pipe materials and specials furnished under this Section conform to all applicable provisions of the corresponding Specifications. Specifically, the Certification shall state compliance with the applicable standards (ASTM, AWWA, etc.) for fabrication and testing.

B. Shop Drawings for major piping (2-inches in diameter and greater) shall be prepared and submitted in accordance with Section 01 33 00 – Submittal Procedures. In addition to the requirements of Section 01 33 00 – Submittal Procedures, the Contractor shall submit laying schedules and detailed Drawings in plan and profile for all piping as specified and shown on the Drawings.

C. Shop Drawings shall include, but not be limited to, complete piping layout, pipe material, sizes, class, locations, necessary dimensions, elevations, supports, hanger details, pipe joints, and the details of fittings including methods of joint restraint. No fabrication or installation shall begin until Shop Drawings are approved by the Engineer.

PART 2 – PRODUCTS

2.01 GENERAL

A. All specials and every length of pipe shall be marked with the manufacturer’s name or trademark, size, class, and the date of manufacture. Special care in handling shall be exercised during delivery, distribution, and storage of pipe to avoid damage and unnecessary stresses. Damaged pipe will be rejected and shall be replaced at the Contractor’s expense. Pipe and specials stored prior to use shall be stored in such a manner as to keep the interior free from dirt and foreign matter.

B. Testing of pipe before installation shall be as described in the corresponding ASTM or AWWA Specifications and in the applicable standard specifications listed in the following Article of this Section. Testing after the pipe is installed shall be as specified in Part 3 of this Section.

C. Joints in piping shall be of the type as specified in the appropriate Piping System Schedule in Section 40 06 20 – Process Pipe, Valve, and Gate Schedules.

D. All exposed piping shall have flanged joints, unless otherwise specified or shown on the Drawings.

E. The Drawings indicate work affecting existing piping and appurtenances. The Contractor shall take whatever measurements that are required to complete the work as shown or specified.

2.02 UNIONS

A. For ductile iron, carbon steel, and grey cast iron pipes assembled with threaded joints and malleable iron fittings, unions shall conform to ANSI B16.39.

B. For copper piping, unions shall have ground joints and conform to ANSI B16.18.

C. For PVC and CPVC piping, unions shall be socket weld type with Viton O-ring.

PART 3 – EXECUTION

3.01 INSTALLATION

A. All piping shall be installed by skilled worker and in accordance with the best standard practice for piping installation as shown on the Drawings, specified or recommended by the pipe manufacturer. Proper tools and appliances for the safe and convenient handling and installing of the pipe and fittings shall be used. Great care shall be taken to prevent any pipe coating from being damaged on the inside or outside of the pipe and fittings. All pieces shall be carefully examined for defects, and no piece shall be installed which is known to be cracked, damaged, or otherwise defective. If any defective pieces should be discovered after having been installed, it shall be removed and replaced with a sound one in a satisfactory manner by the Contractor and at his own expense. Pipe and fittings shall be thoroughly cleaned before they are installed and shall be kept clean until they are accepted in the complete work.

B. All piping connections to equipment shall be provided with unions or coupling flanges located so that piping may be readily dismantled from the equipment. All piping shall be installed in such a manner that it will be free to expand and contract without injury to itself or to structures and equipment to which it is connected. All piping shall be erected to accurate lines and grades with no abrupt changes in line or grade and shall be supported and braced against movement, temporary, or permanent. All exposed piping shall be installed with vertical and horizontal angles properly related to adjoining surfaces or pipes to give the appearance of good workmanship. Unless otherwise shown or approved, provided a minimum headroom clearance under all piping of 7 feet 6 inches.

C. Unless otherwise shown or specified, all waste and vent piping shall pitch uniformly at a 1/4-inch per foot grade and accessible cleanouts shall be furnished and installed as shown and as required by local building codes. Installed length of waste and vent piping shall be determined from field measurements in lieu of the Drawings.

D. All pipe passing through walls and/or floors shall be provided with wall pipes or sleeves in accordance with the specifications and the details shown on the Drawings. All wall pipes shall be of ductile iron and shall have a water stop located in the center of the wall. Each wall pipe shall be of the same class, thickness, and interior coating as the piping to which it is joined. All buried wall pipes shall have a coal tar outside coating on exposed surfaces.

E. JOINT DEFLECTION SHALL NOT EXCEED 75 PERCENT OF THE MANUFACTURER'S RECOMMENDED DEFLECTION. All exposed, submerged, and buried piping shall be adequately supported and braced by means of hangers, concrete piers, pipe supports, or otherwise as may be required by the location.

F. All piping shall be installed in such a manner that it will be free to expand and/or contract without injury to itself or to structures and equipment to which it is connected. All piping shall be erected to accurate lines and grades with no abrupt changes in line or grade and shall be supported and braced against movement, temporary, or permanent. All exposed piping shall be installed with vertical and horizontal angles properly related to adjoining surfaces or pipes to give the appearance of good workmanship. Pipes crossing within a vertical distance of less than or equal to one (1) foot shall be encased and supported with concrete at the point of crossing to prevent damage to the adjacent pipes as shown on the Drawings.

G. Proper and suitable tools and appliances for the safe convenient handling and laying of pipe shall be used and shall in general agree with manufacturer's recommendations.

3.02 CARBON AND STAINLESS STEEL PIPE

A. Installation of steel pipe shall be by skilled worker and shall conform to the applicable sections of AWWA Manual M-11. Joints for steel piping shall be either screwed, welded, or flanged as shown on the Drawings or as specified.

B. Welding in the field shall be performed only when requested on the shop drawings and permitted by the Engineer for carbon steel pipe. No welding of stainless steel pipe shall be allowed in the field. All field welds shall be radiographically inspected.

3.03 JOINTS IN PIPING

A. Flanged joints shall be brought to exact alignment and all gaskets and bolts or studs inserted in their proper places. Bolts or studs shall be uniformly tightened around the joints. Where stud bolts are used, the bolts shall be uniformly centered in the connections and equal pressure applied to each nut on the stud. Pipes in all lines subject to temperature changes shall be cut short and cold sprung into place to compensate for expansion when hot.

B. Mechanical joints shall be made up with gaskets, glands and bolts. When a joint is to be made up, the bell or socket and plain end shall be cleaned and washed with a solution of

mild soap in water; the gland and gasket shall be slid onto the plain end and the end then entered into the socket until it is fully "home" on the centering ring. The gasket shall then be painted with soapy water and slid into position, followed by the gland. All bolts shall be inserted and made up hand tight and then tightened alternately to bring the gland into position evenly. Excessive tightening of the bolts shall be avoided. All nuts shall be pulled up using a torque wrench which will not permit unequal stresses in the bolts. Torque shall not exceed the recommendations of the manufacturer of the pipe and bolts for the various sizes. Care shall be taken to assure that the pipe remains fully "home" while the joint is being made. Joints shall conform to the applicable AWWA Specifications.

C. Threaded and/or screwed joints shall have long tapered full depth threads to be made with the appropriate paste or jointing compound, depending on the type of fluid to be processed through the pipe. All pipe up to, and including 1-1/2-inches, shall be reamed to remove burr and stood on end and well pounded to remove scale and dirt. Wrenches on valves and fittings shall be applied directly over the joint being tightened. Not more than three pipe threads shall be exposed at each connection. Pipe, in all lines subject to temperature changes shall be cut short and cold sprung into place to compensate for expansion when hot. Joints in all piping used for chlorine gas lines shall be made up with a glycerine and litharge cement. Joints in plastic piping (PVC/CPVC) shall be laid and joints made with compounds recommended by the manufacturer. Installation shall conform to the requirements of ASTM D2774 and ASTM D2855. Unions required adjacent to valves and equipment.

D. Soldered joints shall have the burrs removed and both the outside of pipe and the inside of fittings shall be thoroughly cleaned by proper tools recommended for that purpose. Flux shall be applied to both pipe and inside of fittings and the pipe placed into fittings and rotated to insure equal distribution of flux. Joints shall be heated and solder applied until it shows uniformly around the end of joints between fitting and pipe. All joints shall be allowed to self-cool to prevent the chilling of solder. Combination flux and solder paste manufactured by a reputable manufacturer is acceptable. Unions required adjacent to valves and equipment.

E. Welded joints shall be made by competent operators in a first class workmanlike manner, in complete accordance with ANSI B31.1 and AWWA C206. Welding electrodes shall conform to ASTM A233, and welding rod shall conform to ASTM A251. Only skilled welders capable of meeting the qualification tests for the type of welding which they are performing shall be employed. Tests, if so required, shall be made at the expense of the Contractor, if so ordered by the Engineer. Unions shall be required adjacent to valves and equipment.

F. Copper joints shall be thoroughly cleaned and the end of pipes uniformly flared by a suitable tool to the bevels of the fittings used. Wrenches shall be applied to the bodies of fittings where the joint is being made and in no case to a joint previously made. Dimensions of tubing and copper piping shall be in complete accordance with the fittings

used. No flare joints shall be made on piping not suited for flare joints. Installations for propane gas shall be in accordance with NFPA 54 and/or 58.

G. Dielectric isolation such as flange isolation kits, dielectric unions, or similar, shall be installed wherever dissimilar metals are connected according to the following table.

	Zinc	Galvanized Steel	Aluminum	Cast Iron	Ductile Iron	Mild Steel/ Carbon Steel	Copper	Brass	Stainless Steel
Zinc			●	●	●	●	●	●	●
Galvanized Steel			●	●	●	●	●	●	●
Aluminum	●	●		●	●	●	●	●	●
Cast Iron	●	●	●				●	●	●
Ductile Iron	●	●	●				●	●	●
Mild Steel/ Carbon Steel	●	●	●				●	●	●
Copper	●	●	●	●	●	●			●
Brass	●	●	●	●	●	●			●
Stainless Steel	●	●	●	●	●	●	●	●	

Notes:
● signifies dielectric isolation is required between the two materials noted.
Consult Engineer for items not listed in table.
Provide flange isolation kits for all flanged connections of dissimilar metals and hardware including connections to equipment.
Contractor shall include all isolation descriptions with piping submittals.

3.04 FLUSHING AND TESTING

A. All piping shall be properly flushed and tested unless specifically exempted elsewhere in the Specifications or otherwise approved by the Engineer. All liquid conveying pipelines shall be flushed and tested with water. The Contractor shall furnish and install all means and apparatus necessary for getting the air or water into the pipeline for flushing and testing including pumps, compressors, gauges, and meters, any necessary plugs and caps, and any required blow-off piping and fittings, etc., complete with any necessary reaction blocking to prevent pipe movement during the flushing and testing. All pipelines shall be flushed and tested in such lengths or sections as agreed upon among the Owner, Engineer, and Contractor. Test pressures shall be as specified in Section 40 06 20 – Process Pipe, Valve and Gate Schedules and shall be measured at the lowest point of the pipe segment being tested. The Contractor shall give the Owner and Engineer

reasonable notice of the time when he intends to test portions of the pipelines. The Engineer reserves the right, within reason, to request flushing and testing of any section or portion of a pipeline.

B. The Contractor shall provide water for all flushing and testing of liquid conveying pipelines. Raw water or non-potable water may be used for flushing and testing liquid pipelines not connected to the potable water system. Only potable water shall be used for flushing and testing the potable water system.

C. At the conclusion of the installation work, the Contractor shall thoroughly clean all new liquid conveying pipe by flushing with water or other means to remove all dirt, stones, pieces of wood, etc., which may have entered the pipe during the construction period. If after this cleaning any obstructions remain, they shall be corrected by the Contractor, at his own expense, to the satisfaction of the Engineer. Liquid conveying pipelines shall be flushed at the rate of at least 2.5 feet per second for a duration suitable to the Engineer or shall be flushed by other methods approved by the Engineer.

D. During testing the piping shall show no leakage. Any leaks or defective piping disclosed by the leakage test shall be repaired or replaced by the Contractor, at his own expense, and the test repeated until all such piping shows tight.

E. After flushing, all liquid conveying pipelines shall be hydrostatically tested at the test pressure specified in the appropriate Piping System Schedule in Section 40 06 20 – Process Pipe, Valve and Gate Schedules. The procedure used for the hydrostatic test shall be in accordance with the requirements of AWWA C600. Each pipeline shall be filled with water for a period of no less than 24 hours and then subjected to the specified test pressure for 2 hours. During this test, exposed piping shall show no leakage. Allowable leakage in buried piping shall be in accordance with AWWA C600.

F. Any leaks or defective pipe disclosed by the hydrostatic test shall be repaired or replaced by the Contractor, at his own expense, and the test repeated until all such piping shows tight.

3.05 PAINTING AND COLOR-CODING SYSTEM

A. All exposed piping specified shall be color coded in accordance with the Owner's standard color designation system for pipe recognition and in accordance with Section 40 05 97 – Piping and Equipment Identification Systems. In the absence of a standard color designation system, the Engineer will establish a standard color designation for each piping service category from color charts submitted by the Contractor in compliance with Section 09 90 00 – Painting.

B. All piping specified in this Section shall be painted in accordance with Section 09 90 00 – Painting, except as follows:

1. Copper pipe

2. Stainless steel pipe. Flanges and supports or hangers shall be painted.

END OF SECTION

SECTION 40 05 07
PIPE SUPPORTS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Furnish all equipment, labor, materials, and design calculations required to provide pipe supports in accordance with the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Division 03 – Concrete

B. Section 05 05 13 – Galvanizing

C. Section 05 05 23 – Metal Fastening

D. Section 05 10 00 – Metal Materials

E. Section 05 12 00 – Structural Steel

F. Section 05 50 00 – Metal Fabrications

G. Section 09 90 00 – Painting

H. Section 40 05 00 – Basic Mechanical Requirements

I. Section 40 06 20 – Process Pipe, Valve and Gate Schedules

1.03 SUBMITTALS

A. Pipe support submittals will not be reviewed prior to review and acceptance of pipe layout submittal. Pipe support submittal shall be fully coordinated with approved pipe layout submittal. Contractor shall use approved piping layout submittal drawings to show proposed pipe support type and location with accurate dimensions to demonstrate that supports meet all specified requirements.

B. Applicable and associated cut sheets and drawings for materials and support components shall be submitted with the Shop Drawings in accordance with or in addition to the submittal requirements specified in Section 01 33 00 – Submittals, Section 40 05 00 – Basic Mechanical Requirements and all other related referenced Sections listed above.

1. Catalog cut information on all system components such as pipe supports, hangers, guides, anchors, and channel-type supports.

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2. Drawings of the piping support systems, locating each support, brace, hanger, guide, component and anchor. Identify support, hanger, guide and anchor type by catalog number and Shop Drawing detail number.

3. With each piping support system Shop Drawing, the Contractor shall attach calculations prepared and sealed by a Professional Engineer, licensed in the New York State showing that the piping support system complies with the specified requirements, including all building code and seismic code requirements pertaining to support of piping and other non-structural components.

PART 2 – PRODUCTS

2.01 GENERAL

A. The Contractor shall be responsible for the design of all piping support systems unless noted otherwise herein. The absence of pipe supports and details on the Drawings shall not relieve the Contractor of the responsibility of providing a pipe support design sealed by a Professional Engineer, licensed in the New York State .

B. Where a specific location or type of support is shown on the Drawings, the location and type shall be incorporated in the Contractor's pipe support design.

C. Where special pipe support fabrications are required, products and execution shall be as specified in Section 05 50 00 – Metal Fabrications and other related and referenced Sections of the Specifications.

D. Existing piping support systems to support new piping shall only be used if the Contractor can show and demonstrate by submitting supporting calculations that they are adequate for the additional load imposed by the new piping, or if they are strengthened to support the additional load.

E. Contractor's pipe support design should include, but not be limited to, the following criteria and loads imposed on the piping system:

1. Thrust Loads based on the design pressures as specified in Piping Schedules in Section 40 06 20 – Process Pipe, Valve and Gate Schedules. Pipe support design shall not utilize process equipment for thrust restraint or support of piping loads.

2. Dead loads and live loads per the latest version of ASCE/SEI 7 or the local building code if more stringent. Loads shall include, but not be limited to, the following:

a. Weight of pipe

b. Weight of pipe contents

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c. Weight of insulation

d. Ice loads

e. Seismic loading requirements and conditions as specified in the governing building code and referenced seismic design codes. Refer to the structural Drawings for project specific seismic design criteria. Seismic and sway bracing shall be provided at maximum 10-foot centers.

f. Wind loads

3. Loads associated with thermal expansion and contraction of the piping system over the full range of potential temperatures the piping system could experience that should include, but not be limited to, the following:

a. Ambient temperature range per local historical weather data (historic high and low obtained from NOAA)

b. Process operating temperature range

c. Exposure to sunlight where applicable

4. Additional pipe support design considerations shall include the following:

a. A minimum safety factor of 2 or as approved by the Engineer, based upon the yield strength of the support material, shall be used for pipe supports, braces, hangers, and guides as well as for beam and column members used in channel-type support systems.

b. The horizontal pipe hanger and/or floor support spacing shall be as recommended by the pipe and/or hanger manufacturer but shall not exceed 10 feet on center unless indicated otherwise herein or on the Drawings.

c. The design, sizing and spacing of anchor bolts, including concrete anchors, shall be based on withstanding shear and pullout loads imposed by loading at each particular support. The minimum anchor bolt size shall be ½ inches in diameter. Refer to Section 05 05 23 – Metal Fastening.

2.02 HANGERS AND SUPPORTS

A. All piping shall be adequately supported and braced by means of steel hangers and/or supports, concrete piers, supplemental lateral bracing components, prefabricated brackets, or otherwise as may be required by the location and forces applied per governing code, including gravity and lateral forces from earthquake and/or wind (if outdoors). Generally, concrete supports shall be used where pipe centerline is less than 3 feet above floor, and hangers above 6 feet unless specified or shown otherwise. Supports shall be not more than 10 feet on center for steel and cast iron, 5 feet on

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center for plastic unless otherwise shown on the Drawings or required by the specific manufacturer. All necessary inserts or appurtenances shall be furnished and installed in the concrete or structures for adequately securing hangers and supports to the structure. Refer to Standard Detail Drawings.

1. Metal pipe support materials, where stainless steel pipe is supported, shall be Type 304L stainless steel meeting the requirements of Section 05 13 00 – Stainless Steel.

2. Metal pipe support materials, where carbon steel, ductile or other ferrous pipe is supported, shall be galvanized carbon steel meeting Section 05 12 00 – Structural Steel and Section 05 05 13 – Galvanizing unless indicated otherwise on the Drawings or in the Specifications or by the Engineer.

3. Metal pipe supports indicated as standard type pipe hangers are designed and detailed for gravity loading only. Resulting lateral loads from wind, earthquake, or other lateral loads per code, or special loading conditions during construction, shall be applied to the pipe in accordance with the governing building code. Supplemental lateral stiffening members (when necessary) shall be provided along pipe or at gravity supports using appropriate supplemental members and connections when required by calculations. The Contractor shall include design calculations and details with all pipe hangar and support submissions for review by the Engineer. The main structure and structural components that will support the pipe hangers and other appurtenant components of the facility have been designed to resist all resulting secondary lateral loading from pipe hangers and other non-structural members for gravity and resulting lateral loads.

B. Hangers and supports shall conform to the following requirements:

1. All fabricated metal hangers and supports shall be capable of adjustment after installation. Different types of hangers and supports along a pipe length, including bends, shall be kept to a minimum.

2. Hanger rods shall be straight and vertical. Chain, wire, strap, or perforated bar hangers shall not be used. Hangers shall not be suspended from other piping.

3. Vertical piping shall be properly supported at each floor and between floors by stays or braces to prevent rattling and vibration.

4. Supports and hangers for plastic and FRP piping shall include wide saddles or bands as recommended by the manufacturer and approved by the Engineer to distribute load and thus avoid localized deformation of the pipe.

5. Hanger and supports shall prevent contact between dissimilar metals by use of copper plated, rubber, vinyl coated or stainless-steel hangers.

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6. Ferrous pipes to be painted shall be painted in accordance with Section 09 90 00 – Painting. Ferrous pipes that require painting or galvanizing shall be supported by galvanized hangers and supports. Stainless steel piping shall be supported by stainless steel saddles and straps (if required).

7. Copper piping shall be supported by plastic coated or copper plated steel hangers and supports.

8. Plastic piping shall be supported by plastic coated steel hangers and supports.

9. Hangers and supports shall provide for thermal expansion throughout the full operating temperature range.

10. Expansion and adhesive type anchors used for pipe hangers and supports shall be Type 316 stainless steel.

C. Metallic hangers and supports may be standard make by Anvil International, Inc., "Witch" by Carpenter & Paterson, Ltd., B-Line Systems, Inc., or approved equal. The Contractor shall furnish and submit data on the types and sizes to be used to the Engineer for approval. Metallic support system brackets, rods, support clips, clevis hangers, hardware, etc. shall be cast iron or welded steel construction. All gravity type hangers and supports shall be restrained laterally to resist seismic loading and other loading as required by the governing code.

D. Non-metallic support system shall be a heavy-duty channel framing system. Channel frames shall be manufactured by the pultrusion process using corrosion grade polyester or vinylester resins. All fiberglass construction shall include suitable ultraviolet inhibitors for UV exposure and shall have a flame spread rating of 25 or less per ASTM E84. Piping accessories, pipe clamps, clevis hangers, support posts, support racks, fasteners, etc., shall be constructed of vinylester or polyurethane resin. Non-metallic support systems shall be standard make Aickinstrut by Aickinstrut, Inc., Unistrut Fiberglass by Unistrut, Inc., Enduro Fiberglass Systems, or approved equal. The Contractor shall furnish and submit data on the types and sizes to be used to the Engineer for approval. Unless otherwise shown or specified, the Contractor shall provide support spacings in conformance with the pipe and support system manufacturer's requirements.

PART 3 – EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Support piping connections to equipment by pipe support and not by the equipment.

B. Support large or heavy valves, fittings, flow meters and appurtenances independently of the connected piping.

C. Support no pipe from the pipe above it.

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D. Support piping at changes in direction or in elevation, adjacent to flexible joints, expansion joints, and couplings, and where shown.

E. The Contractor shall not install piping supports and hangers in equipment access areas or bridge crane runs.

F. Brace hanging pipes against horizontal movement by both longitudinal and lateral sway bracing.

G. Install pipe anchors (fixed supports and/or guides) where shown and/or as may otherwise be required to withstand expansion thrust loads and to direct and control thermal expansion. The Contractor may install additional pipe anchors and flexible couplings to facilitate piping installation, provided that complete details describing location, pipe supports, and hydraulic thrust protection are submitted.

END OF SECTION

SECTION 40 05 19
DUCTILE IRON PIPE

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Related Sections:

1. Section 09 90 00 – Painting.

2. Section 40 05 00 – Basic Mechanical Requirements

3. Section 40 06 20 – Process Pipe, Valve, and Gate Schedules, for pressure rating requirements for specific applications.

1.02 SUBMITTALS

A. Submittals shall be provided in accordance with Section 01 33 00 – Submittal Procedures.

B. The Contractor shall submit a certificate from the Manufacturer stating that all linings have been provided in accordance with the specification requirements herein.

PART 2 – PRODUCT

2.01 DUCTILE IRON PIPE AND FITTINGS

A. All ductile iron pipe and specials shall be marked with the manufacturer's name or trademark, size, weight, thickness class, the date of manufacture, and the word "Ductile".

B. Ductile iron pipe of the sizes shown or specified shall conform to AWWA C151/A21.51, Grade 60-42-10 for ductile iron pipe centrifugally cast in metal molds or sand-lined molds.

C. Ductile iron pipe shall conform to AWWA C150/A21.50 for thickness design and shall be supplied in 18-foot or 20-foot nominal lengths or as required to meet the requirements of the Drawings.

D. Fittings and specials shall be cast iron or ductile iron and conform to the requirements of AWWA C110/A21.10 and AWWA C153/A21.53.

E. Minimum Class 53 pipe shall be used for flanged spools.

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2.02 PIPE COATINGS

A. All buried ductile iron pipe and fittings shall have a bituminous coating of standard thickness on the exterior surfaces in accordance with AWWA C151/A21.51.

B. All exposed ductile iron pipe and fittings shall have a shop-applied prime coat in accordance with Section 09 90 00 – Painting.

2.03 PIPE LININGS

A. All pipe and fittings, with the exception of epoxy and glass lined pipe and sleeves, shall be cement mortar lined. Cement mortar linings shall conform to American Standard Specifications for Cement Mortar Lining for Cast Iron Pipe and Ductile Iron Pipe and Fittings, AWWA C104/A21.4 and shall be standard thickness. The mortar lining shall be protected with a bituminous seal coat.

B. Epoxy-Lined Pipe

1. Epoxy-lined ductile iron pipe shall be furnished and installed where specified in Section 40 06 20 – Process Pipe, Valve, and Gate Schedules.

2. Epoxy-linings shall be Induron Protecto 401 ceramic epoxy lining, Tnemec Perma-Shield PL Series 431, or approved equal.

3. The finished lining shall have a minimum dry film thickness of 40 mils, except at the gasket groove and spigot end up to six inches back from the end of the spigot which shall be 6 mils dry film thickness, minimum.

4. Lining application shall be performed in strict accordance with the manufacturer's instructions by an applicator approved by the coating manufacturer and under controlled conditions at the applicator's shop or the pipe manufacturer's plant.

C. Glass-Lined Pipe

1. Glass-lined ductile iron pipe shall be furnished and installed where specified in Section 40 06 20 – Process Pipe, Valve, and Gate Schedules.

2. Glass-lined ductile iron pipe shall be provided in accordance with ASTM B1000.

3. Glass linings shall be Ervite Type SG-14, as manufactured by the Ervite Corporation; Ferrock MEH 32, as manufactured by Water Works Supply and Manufacturing, Co; or approved equal.

4. The finished lining shall have a dry film thickness between 8 and 12 mils; a hardness between 5 and 6 on the Mohs Scale; a density between 40 and 50 grams per cubic inch (2.5 to 3.0 grams per cubic centimeter) as measured in

accordance with the requirements of ASTM D792; and be capable of withstanding a thermal shock of 350°F without crazing, blistering, or spalling.

5. Glass-lined pipe and fittings that have been lined must be handled from the outside. No forks, chains, hooks, etc. shall be placed inside the pipe and fittings for lifting, positioning, or laying.

6. Cutting of glass lined pipe in the field shall be limited to only one piece per run of pipe, and this shall be for closure purposes only. Spalling of the glass liner shall be no more than 1/8-inch back from the cut. Flanges and bolt holes on spool pieces shall be aligned following the glass lining process and shall be sealed and tested prior to shipment in accordance with the manufacturer’s recommendation. Warping of flanges and/or pipe may be cause for rejection as determined by the Engineer.

2.04 PIPE JOINTS

A. Requirements for various types of joints are described in the following paragraphs. UNLESS OTHERWISE NOTED HEREIN OR ON THE DRAWINGS, ALL EXPOSED DUCTILE IRON PIPING SHALL HAVE FLANGED JOINTS.

B. Flanged Joints

1. Flanged joints and fittings shall have a minimum pressure rating of 250 psi with 125 lb. American Standard flanges.

2. All flanges and fittings shall conform to the requirements of ASME B16.1.

3. Flanges shall be ductile iron and shall be of the threaded or screw on type.

4. The face of the flanges shall be machined after installation of the flange to the pipe. No raised surface shall be allowed on flanges.

5. Flanged pipe shall conform to the requirements of AWWA C115/A21.15.

6. Pipe lengths shall be fabricated to meet the requirements of the Drawings.

7. Gaskets shall be Toroseal by American Cast Iron Pipe Company, Flange-Tyte by US Pipe, or approved equal. Gaskets shall be full-face, 1/8-inch minimum thickness cloth inserted rubber, red rubber, neoprene, or superior elastomer and shall be compatible with the fluid being conveyed. Gaskets shall have an allowable maximum working pressure and temperature equal to or greater than the service in which it is installed.

8. Bolts shall be of the size and length called for and in accordance with the "American Standard" and comply with the requirements of the ANSI/AWWA Standards. Bolts used for exposed flanged joints shall be a minimum ASTM A307, Grade B carbon steel, and be in accordance with AWWA C110/A21.10. Bolts used

for flanged joints in submerged applications shall be Type 316 stainless steel and installed with dielectric isolation flange kits and anti-seize. All bolts shall have hexagonal heads and nuts of the same material as the bolt. No washers shall be used.

C. Bell and Spigot Joints

1. Bell and spigot pipe shall be provided with push on, Oring rubber gasket, compression type joints and shall conform to the requirements of AWWA C111/A21.11. Fittings and specials shall be supplied with mechanical joints as specified for mechanical joint pipe. If required by installation conditions, pipe shall have caston lugs for adequately tying it together.

D. Mechanical Joints

1. Mechanical joints and fittings shall conform to the requirements of AWWA C111/A21.11. Joints shall be made employing a tapered rubber gasket forced into a tapered groove with a ductile iron follower ring. If required by installation conditions, pipe and fittings shall have caston lugs for adequately tying the pipe and fittings together. These shall be in conformance with standard practice and as outlined under the appropriate AWWA Specifications.

2. Bolts for mechanical joints shall be high-strength low-alloy steel tee-head bolts with hexagonal nuts per AWWA C111/A21.11, both coated using a three-layer system consisting of a metallic base coat, an adhesion coat, and a heat cured fluoropolymer compound containing PTFE as topcoat.

3. Mechanical coupling joint pipe and fittings shall be split type, shouldered end. Coupling materials shall be malleable iron. Couplings shall have a minimum pressure rating and service equal to that of the connected piping.

4. Gaskets shall be of rubber.

5. After installation, buried couplings shall receive two heavy coats of coal tar epoxy (min. 24 mil thickness) which is compatible with the finish of the couplings.

6. Couplings shall be as manufactured by Victaulic Company of America Style 31, or approved equal.

E. Restrained Joints

1. Restrained joint pipe shall consist of factory manufactured bolted retainer rings, ductile iron locking segments held in place by rubber retainers, or ductile iron retaining rings that lock over the bell of the joint and are secured to prevent rotation, and factory welded retainer beads or rings on the spigot of the pipe. All components of the bolted or snap ring assemblies shall be constructed of

corrosion-resistant, high strength, low-alloy steel coated using a three-layer system consisting of a metallic base coat, an adhesion coat, and a heat cured fluoropolymer compound containing PTFE as topcoat.

2. Restrained joint pipe shall be Flex-Ring or Lock-Ring type joints as manufactured by American Cast Iron Pipe Company, HP LOK or TR Flex as manufactured by US Pipe, Bolt-Lok or Snap-Lok as manufactured by Griffin Pipe Products, TR Flex or Super Lock as manufactured by Clow Water Systems Co., or approved equal.

3. Restrained fittings for piping systems 16-inches in diameter and greater shall have factory restraint systems identical to the factory restrained joint pipe specified above. All fittings shall be minimum pressure Class 250 unless otherwise specified.

4. Restrained fittings for pipe systems 14-inches in diameter and smaller shall be Mechanical Joint fittings with restraint assemblies such as Stargrip by Star Pipe Systems, Mega Lug by EBAA Iron, ONE LOK by Sigma, Grip Ring by Romac, or approved equal. Restraint assemblies including all hardware shall be painted with two heavy coats of coal tar epoxy after installation. Where threaded-rods are allowed, the rods and tabs shall be designed for the specified restraint system design pressure, shall have lengths less than 10 feet between fittings, and shall be painted with two heavy coats of coal tar epoxy after installation.

5. The manufactured systems for thrust restraint indicated above shall be used where restrained joint ductile iron pipe and fittings are specified or indicated on the drawings. Gripping gaskets are not an acceptable form of restraint. Thrust restraint and harnessing systems such as threaded-rods, friction clamps, retainer glands shall be used only where specifically specified herein, indicated on the drawings or if allowed by the Engineer in isolated applications where conditions warrant and necessitate their use. Concrete thrust blocks may be used in accordance with the schedule indicated on the drawings, if applicable.

2.05 OUTLETS

A. The Contractor shall provide taps on piping where required or shown on the Drawings. Where pipe or fitting wall thicknesses are insufficient to provide the required number of threads, the Contractor shall not use taps and shall refer to Section 40 05 00 – Basic Mechanical Requirements for requirements.

2.06 POLYETHYLENE ENCASEMENT

A. Wrap all buried ductile iron pipes, valves and fittings with 8 mil polyethylene film per ANSI A21.5/AWWA C-105. Use only tube type for pipe. Complete the wrap prior to placing concrete anchors, collars, supports or thrust blocks. Repair polyethylene if damaged during installation.

2.07 CAST IRON SOIL PIPE

A. Cast Iron Soil Pipe shall conform to the standards of the Cast Iron Soil Pipe Institute (CISPI) Specification HS-67, and also ANSI Specification A-112.5.2 for Hub & Spigot pipe or A.112.5.1 for Hub & Spigot pipe or A.112.5.1 for No-Hub Pipe. Pipe class shall be "Extra Heavy:(XH).

END OF SECTION

SECTION 40 05 58
GATE OPERATORS AND ELECTRIC GATE ACTUATORS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Equipment shall be provided in accordance with the requirements of Section 46 00 00 – Equipment General Provisions and Section 40 05 00 – Basic Mechanical Requirements.

B. Reference Section 40 06 20 – Process Pipe, Valve, and Gate Schedules for additional information on gates and operators/actuators.

C. The electric gate actuators shall meet the signal requirements described in Section 40 61 23 – Signal Coordination Requirements, Section 40 61 93 – Process Control System Input/Output List, and Section 40 61 96 – Process Control Descriptions.

D. Gate operators and electric gate actuators shall be designed to unseat, open or close, and seat the gate under the most adverse operating condition to which the gates will be subjected.

E. Operator mounting arrangements shall be as indicated on the Drawings or as directed by the manufacturer and/or Engineer. There shall be no mounting restrictions on the electric gate operator.

F. The gate operators and electric actuators shall be the full and undivided responsibility of the gate manufacturer in order to ensure complete coordination of the components and to provide unit responsibility.

1.02 SUBMITTALS

A. The following items shall be submitted in accordance with, or in addition to the submittal requirements specified in Section 01 33 00 – Submittal Procedures and Section 46 00 00 – Equipment General Provisions:

1. Shop Drawings

2. O&M Manuals

3. Certification that the force required to operate all gates is as specified herein.

1.03 WARRANTY AND GUARANTEE

A. Warranty and Guarantee shall be as specified in Section 46 00 00 – Equipment General Provisions with the exception that the warranty period shall be for two (2) years.

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PART 2 – PRODUCTS

2.01 GENERAL

A. Electric actuators shall be provided where specified in the Gate Schedules in Section 40 06 20 – Process Pipe, Valve, and Gate Schedules. Manual operators shall be provided on all gates which do not receive electric actuators.

B. Manual operators and electric actuators shall be mounted on either a floorstand or a benchstand as specified in the Gate Schedules in Section 40 06 20 – Process Pipe, Valve, and Gate Schedules and as shown on the Drawings.

1. Floorstands shall consist of a cast iron pedestal designed to position the input shaft or handwheel approximately 36-inches above the operating floor. Floorstands shall be of the straight or offset design as specified herein or as shown on the Drawings.

2. Benchstands shall be provided with a rectangular cast iron base machined and drilled for mounting purposes.

C. All operators shall be provided with a 316 stainless steel stem cover to protect the rising stem from moisture, dirt, and damage.

1. A gate position indicator shall be provided on the gate operator for visual indication of gate position.

2. The top of the stem cover shall be closed and the bottom shall be designed for easy field mounting to the gearbox.

3. The bottom of the stem cover shall be designed to mount to the gearbox in such a way that all moisture is drained out to protect the stem and gearbox. Accumulated moisture of any amount on top of the gearbox inside the stem cover is unacceptable.

2.02 MANUAL OPERATORS

A. Manual operators shall be provided by the gate manufacturer. Manual operators shall be handwheel or handcrank operated as indicated on the Drawings and specified in the Gate Schedule.

1. Manual operation shall require no greater than a 40 pound pull on the crank or handwheel with the specified operating head on the gate.

2. Manual operators shall be provided with a threaded cast bronze lift nut to engage the operating stem. Tapered anti-friction roller or ball thrust bearings shall be provided above and below a flange on the operating nut to support both opening and closing thrusts.

3. Lubricating fittings and extensions shall be provided for the lubrication of all gears and bearings.

4. An arrow with the word "open" shall be permanently attached or cast on the floorstand, benchstand, or handwheel indicating the direction of rotation to open the gate. Unless otherwise noted, all operators shall turn counter-clockwise to open.

5. All sluice gates and slide gates 3 ft. wide and larger shall be crank-operated, unless otherwise indicated herein as shown on the Drawings.

B. Handwheel operators shall be furnished without gear reduction. The removable handwheel shall be fabricated steel or cast iron, designed for rough treatment and minimum weight. Handwheels shall not be less than 12 inches in diameter. The maximum diameter of any handwheel shall not exceed 24 inches.

C. Crank-operated type manual operators shall have either single or double gear reduction depending upon the lifting capacity required.

1. Crank operators shall be suitable for operation by a portable gate operator.

2. Gearing shall be steel or cast iron with machine cut teeth designed for smooth operation.

3. The pinion shafts on crank-operated floorstands, either single or double, shall be stainless steel, and supported on tapered roller bearings.

4. All components shall be totally enclosed in a cast iron weather-proof housing with cover.

5. Positive mechanical seals shall be provided on the operating nut and the pinion shafts where they extend from the cast iron case or gear box to retain lubricant and to exclude moisture and dirt.

6. The removable crank shall be cast iron with a revolving brass grip.

2.03 ELECTRIC GATE ACTUATORS

A. Electric Actuators shall be open/close service or modulating service as specified in the Gate Schedule in Section 40 06 20 – Process Pipe, Valve, and Gate Schedules.

1. Open/Close (non-modulating) gate actuators shall be IQ series as manufactured by Rotork, SA series as manufactured by AUMA, or Series 2000 as manufactured by EIM Controls, or approved equal.

B. Performance Requirements

1. The actuators shall be designed for indoor and outdoor service and shall be capable of mounting in any position.

2. Torque capacity of the actuators shall be sufficient to operate the gates with the maximum pressure differential, as indicated in the Gate Schedule in Section 40 06 20 – Process Pipe, Valve, and Gate Schedules, with a safety factor of 1.5. Actuators in modulating service will be selected such that the required dynamic gate torque is no more than 60% of the electric actuator's maximum rated breakaway of torque.

3. The electric actuator shall provide for a gate travel speed of 12 inches per minute unless otherwise approved by Engineer.

4. Actuators shall be capable of operating in ambient temperatures ranging from 0 degrees F – 160 degrees F.

5. For open/close (non-modulating) actuators, the gearing, motor and contactor shall be capable of 60 starts per hour without overheating.

C. The actuators shall include, in one integral housing, individual compartments for the motor, gearing, wiring terminals, and control circuits (including auxiliary switches plus position sensing device where required). The terminal compartment shall be separated from the inner electrical components of the actuator by means of a watertight seal. The inner seal shall protect the motor and all other internal electrical elements of the actuator from entrance of moisture and dust when the terminal cover is removed. Double cartridge shaft seals shall be provided on the hand wheel and output shafts for weatherproof protection. All external fasteners shall be stainless steel. Compartments shall be provided with moisture and dust-proof rigid cast covers meeting NEMA 6, certified to submergence in 6 ft of water for 30 minutes. Actuators located in classified areas shall be suitable for use in Class 1, Division 1, Group D environments.

D. The actuators shall be provided with externally operable and lockable 480VAC circuit breakers integral to the control housing.

E. All gearing shall be hardened alloy steel or bronze and shall be rated at twice the output torque of the operator and shall be designed to withstand the stall torque of the motor without failure. Output drive gearing shall consist of a worm shaft and worm gear pinion operating in an oil bath. The worm gear pinion shall be alloy bronze. Worm gear drive shall be self-locking to prevent creeping of the gate in an intermediate position. Heavy-duty grease shall protect gearing and sealed ball bearings of the main shaft for five years without changing. Motor reduction gearing shall be spur or planetary gearing and shall allow for field repair and change in gear ratio.

F. A mechanical dial position indicator shall be furnished to continuously indicate the position of the gate at and between the fully open and fully closed positions. The

indicator shall be driven by gearing driven off of the main worm gear pinion and shall operate when the actuator is in either the electrical mode or manual mode.

G. A handwheel shall be permanently attached for manual operation. A gear assembly shall be provided between the handwheel and the worm shaft if required to reduce the force necessary to operate the handwheel to less than 40 pounds. A positive declutch mechanism shall engage the handwheel when required. When the actuator is set in the declutched position for handwheel operation, it shall return automatically to electric operation when actuator motor is energized. The handwheel shall not rotate during electric operation nor shall a fused motor prevent handwheel operation.

H. The drive motor shall be specifically designed for actuator service and shall be characterized by high starting torque and low inertia. Motors shall be 460 volts, three phase, 60 Hz AC reversible squirrel cage induction type motors and shall be specifically designed for modulating service where indicated on the Gate Schedule in Section 40 06 20 – Process Pipe, Valve, and Gate Schedules. Motors shall be totally enclosed, non-ventilated, with NEMA Class F insulation minimum (Class H for modulating actuators) and a maximum continuous temperature rating of 120 degree C (rise plus ambient). A 120 VAC space heater shall be provided in the motor compartment. The electric motor shall have a time rating of at least 15 minutes at 104ºF (40ºC) or twice the gate stroking time, whichever is longer, at an average load of at least 33% of maximum gate torque. Motor bearings shall be permanently lubricated by premium lubricant. The motor shall have plug and socket electrical connection to facilitate easy removal and replacement. The actuator shall include a device to ensure that the motor runs with the correct rotation for the required direction of gate travel with either phase sequence of the three-phase power supply connected to the actuator. The motor shall include single phase protection. A suitable thermal protection device shall be incorporated in the motor or motor starter circuits, connected to a tripping device. Fast acting fuses shall be provided to protect solid state components. The motor shall be capable of starting against the rated load in either the open or close direction when voltage to the motor terminals is plus or minus ten (10) percent of nameplate rating

1. Open/Close actuators shall be furnished with electro-mechanical reversing starters.

I. Leads from the motor shall be brought to the control circuit (limit switch) compartment without external piping or conduit box. An adequately sized space heater shall be installed in the control circuit compartment to aid in the prevention of damage resulting in from condensation. The following items shall be located in the control circuit compartment.

1. Torque limit switches shall be provided to de-energize the motor control circuit in the event of a stall when attempting to unseat a jammed gate and when torque is exceeded during gate travel. Each actuator shall have an open direction torque switch and a close direction torque switch. The torque switches shall be

mechanically operated and able to be set in torque units. Torque switches shall be calibrated prior to the actuator's assembly to the gate.

2. Travel limit switches shall be provided to de-energize the motor control circuit when the actuator reaches the limits of travel in the open and close directions. The limit switch drive shall be of the counter gear type and "in step'" with the actuator output drive at all times in either the electrical or manual mode of operation. A minimum of six (6) contacts, three (3) normally open and three (3) normally closed, shall be supplied at each end of gate travel. Four (4) additional contacts shall be provided to report end of travel or any desired position between ends of travel.

J. The electrical terminals shall be housed in a double sealed terminal compartment isolated from the rest of the actuator components. The actuators shall be designed to operate from a single 480VAC, 3-phase source. The actuators shall be furnished with fuses inside of the terminal compartment. A quantity of two – ¾ inch NPT conduit entries shall be furnished.

K. Actuators shall contain wiring and terminals for the following control functions. All dry contacts shall be rated for 5A at 250VAC.

1. Open, Close, and Stop commands from external dry contacts (utilizing internal 24VDC power supply) and/or from an external signal of 12V to 120V. The inputs for the open, close, stop signals shall be field selectable to be respond to either maintained or momentary remote signals. In momentary mode, the actuator shall have internal latching circuitry that causes the operator to drive the gate to its limit of travel upon receipt of the momentary contact signal unless a stop signal is received.

2. Emergency override input from a normally closed or normally open contact. The actuator shall either open or close (field selectable) upon receiving the emergency override input.

3. Remote Local-Off-Remote selector switch, Open/Close pushbuttons, and Open/Closed pilot lights for a remote manual control station (see below). The remote Local-Off-Remote selector switch and Open/Close pushbuttons shall be a dry contact input to the actuator control circuitry. The Open/Closed pilot lights shall be powered from the gate actuator control power.

4. Four (4) unpowered contacts shall be provided which can be selected to indicate gate "Opened" and "Closed" position, "Remote" status of the actuator, and fail status of the actuator. The fail status contacts shall activate upon motor overtemperature and actuator overtorque as a minimum.

5. Terminals for 4-20mADC position command and 4-20mADC position feedback as described above for modulating actuators.

L. Local Controls

1. Actuators shall be furnished with a Local-Off-Remote selector switch; Open, Close, and Stop pushbuttons for local control; a red lamp indicating closed and a green lamp indicating open. L-O-R switch shall be padlockable in any of the three positions.

    a. When the LOR is in the “Local” position, open/close control shall be by the open and close pushbuttons on the actuator. The stop push button shall stop the actuator travel.

    b. When the LOR is in the “Off” position, the actuator shall not operate.

    c. When the LOR is in the “Remote” position, the actuator shall be controlled by remote inputs from the PLC or from the remote manual controls station.

2. The local controls shall be arranged so that the direction of travel can be reversed without the necessity of stopping the actuator.

M. Remote Manual Control Station

1. Where indicated in the Gate Schedules in Section 40 06 20 – Process Pipe, Valve, and Gate Schedules, manual actuator controls shall be furnished in a separate NEMA 4X stainless steel enclosure (NEMA 7 if located in a classified area). Manual control station controls shall include Hand–Off-Auto Selector switch; Open, Stop, and Close pushbuttons; a red lamp indicating closed and a green lamp indicating open.

    a. When the HOA is in the “Hand” position, open/close control shall be by the open and close pushbuttons on the remote manual control station. The stop push button shall stop actuator travel.

    b. When the HOA is in the “Off” position, the actuator shall not operate.

    c. When the HOA is in the “Auto” position, the actuator shall be controlled by remote inputs to the actuator from the PL

2.04 PORTABLE ELECTRIC OPERATOR

A. A portable electric operator shall be provided to operate manual crank operated gates. The portable operator shall consist of a heavy duty electric drill, an overload release clutch, a support tripod, and all accessories required for a complete and operable system.

1. The drill shall be a reversible, 1-1/4 inch, heavy duty, ball bearing drill as manufactured by Milwaukee Electric Tool Company or approved equal.

2. The drill shall operate on a 120 VAC power supply (standard grounded plug).

3. The overload release clutch shall release at a torque of 70 ft-lbs.

2.05 SPARE PARTS

A. Not Used.

PART 3 – EXECUTION

3.01 MANUFACTURER'S FIELD SERVICES

A. Not used.

3.02 INSTALLATION

A. All gate actuators shall be installed in accordance with the manufacturer's published recommendations and the applicable Specification Sections for gates and motor controls.

B. Gate actuators shall be factory coated in accordance with the manufacturer's standard paint system.

3.03 SHOP TESTING

A. Shop testing shall be in accordance with Section 46 00 00 – Equipment General Provisions and with the following additional requirements:

1. Conduct a complete functional check of each unit. Correct any deficiencies found in shop testing prior to shipment.

2. Submit written certification that:

a. Shop tests for the electrical system and all controls were successfully conducted;

b. Electrical system and all controls provide the functions specified and required for proper operation of the gate operator system.

3. Each actuator shall be performance tested and individual test certificates shall be supplied free of charge. The test equipment shall simulate each typical gate load and the following parameters should be recorded:

a. Current at maximum torque setting

b. Torque at maximum torque setting

c. Flash Test Voltage

d. Actuator Output Speed or Operating Time

e. In addition, the test certificate should record details of specification, such as gear ratios for both manual and automatic drive, closing direction, and wiring diagram code number.

f. Verification of actuator torque rating with gate.

3.04 FIELD TESTS

A. Field testing shall be in accordance with Section 46 00 00 – Equipment General Provisions and with the following additional requirements:

1. Gate actuators shall be field-tested together with the associated gates.

2. Perform field tests to check and adjust system components, and to test and adjust operation of the overall system, in accordance with Section 46 00 00 – Equipment General Provisions.

a. Preliminary field tests shall be conducted prior to start-up.

b. Final field tests conducted during start-up.

3. Preliminary and final field tests shall be conducted at a time approved by the Engineer.

4. Test all gates at the operating pressures at which the particular line will be used.

5. Test all gates for control operation as directed.

6. Field testing shall include optimization of opening and closing times of the gates. Gate opening and closing times shall be adjusted based on process requirements to optimize operation of the gates. Final gate opening and closing times as determined by field tests shall be approved by the Engineer prior to final acceptance of the system.

B. Preliminary Field Tests

1. General: Preliminary field tests shall be conducted prior to start-up and shall include a functional check of the entire gate operator system and all system components.

2. Scope: Preliminary field tests shall demonstrate that the gate operator system performs according to specifications and that all equipment, gates, controls, alarms, interlocks, etc., function properly.

3. Based on results of preliminary field tests, the Contractor shall make any adjustments required to settings, etc., to achieve the required gate closing time and operation, as specified or otherwise directed.

C. Final Field Tests

1. Final field tests shall be conducted in accordance with the latest revision of AWWA C500.

2. Final field tests shall be conducted simultaneously with the start-up and field testing of the pumps.

3. Final field tests shall be conducted for the full range of operating modes and conditions specified and as directed by the Engineer. Each of the gates shall be tested at minimum, maximum, and normal head/flow conditions, and under all specified conditions of opening and closing.

4. Certification of Equipment Compliance: After the final field tests are completed and passed, submit affidavit according to Section 46 00 00 – Equipment General Provisions.

END OF SECTION

SECTION 40 05 59.16

STOP LOGS (ALUMINUM)

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required, to furnish and install aluminum stop log planks, stainless steel guides, stop log lifters, and stop log storage racks with all appurtenances and accessories, complete and operational.

B. Section Includes: Stainless steel guides, aluminum stop logs, lifting devices and storage racks.

C. The following index of this Section is presented for convenience:

D. Refer to Section 40 06 20 – Process Pipe, Valve, and Gate Schedules for further detail on log stop dimensions, design criteria and number required.

1.02 RELATED SECTIONS

A. Section 03 21 00 – Reinforcing Steel.

B. Section 40 06 20 – Process Pipe, Valve and Gate schedules

1.03 REFERENCES

A. Reference Standards:

1. ASTM A240 Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

2. ASTM B209 Aluminum and Aluminum-Alloy Sheet and Plate

3. ASTM B221 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

4. ASTM D2000 Classification System for Rubber Products in Automotive Applications.

5. ASTM D4020 Ultra-High-Molecular-Weight Polyethylene Molding and Extrusion Materials

6. ASTM F593/594 Stainless Steel Bolts, Hex Cap Screws, and Studs, Nuts

SECTION 40 05 59.16

STOP LOGS (ALUMINUM)

1.04 DESCRIPTION

A. The aluminum stop log planks shall be designed for seating head and seals shall be provided for this condition.

1.05 QUALITY ASSURANCE

A. In accordance with the procedures and requirements set forth in the General Conditions of the Contract and Division 1 – General requirements, the following provisions shall pertain to Work under this Section:

B. Manufacturer's Qualifications:

1. The Contractor shall provide evidence to the Engineer that the manufacturer has a minimum of ten (10) years' experience, in the design, manufacture, and supervision of installation of equipment of the type required under this Section.

2. The Contractor shall provide evidence to the Engineer that equipment which was designed and manufactured by the manufacturer, and which is similar to the equipment required under this Section, has been in continuous and successful operation in at least five (5) separate facilities for the past five (5) years.

C. All welds shall be performed by welders with AWS certification.

D. Finish: Mill finish on aluminum and stainless steel. All aluminum in contact with concrete shall be field coated by the CONTRACTOR with a heavy coat of bitumastic paint. Welds on aluminum shall be cleaned to provide a uniform finish. Welds on stainless steel shall be sandblasted to remove weld burn and scale.

E. Quality Assurance Inspections:

1. The Contractor shall give ample notice to the Engineer prior to the beginning of any fabrication, so that Quality Assurance inspection may be made.

2. Quality Assurance inspections shall include (but are not limited to) the following activities:

a. Obtain representative material samples.

b. Obtain copies of Certified Materials Test Reports (both chemical and physical) and Manufacturer's Certificates of Conformance.

c. Perform visual inspection of welding, as per applicable welding code.

d. Perform visual and dimensional inspection of completed work.

e. Witness surface preparation and finishing or coating and lining operations, paint peel tests, and holiday tests, as applicable.

f. Witness any required hydrostatic tests.

1.06 SUBMITTALS

A. All submittals shall be in accordance with Section 01 33 00 – Submittal Procedures or as specified herein. In addition, submittals shall include, but not be limited, to:

1. Action Submittals:

a. Detailed dimensional drawings.

b. Assembly and installation drawings.

c. Location and details of stop log plank storage rack.

d. Submit detailed structural computations sealed by a New York State Professional Engineer for the stop logs, frames and storage rack system showing that stresses and deflections are within specified limits.

e. Anchoring details for the storage rack system including information on plan to avoid cutting existing reinforcing steel in accordance with Section 03 21 00 – Reinforcing Steel Article 3.02. F.

2. Information Submittals:

a. Material certification and specifications.

1.07 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall deliver materials provided under this Section in accordance with the requirements of the Contract Documents.

B. The Contractor shall store and handle materials provided under this Section in accordance with the requirements of the Contract Documents.

1.08 SPARE PARTS, SPECIAL TOOLS, AND SUPPLIES

A. Not Used.

1.09 SPECIAL WARRANTY PROVISIONS/ GUARANTEE PERIODS

A. Not Used.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. RW Gate Company, Troy, NY;

B. Whipps, Inc., Athol, MA

C. Or approved equal

2.02 MATERIALS/EQUIPMENT

A. Materials:

Components	Materials
Frames, Guides and Invert	Stainless Steel, Type 316, ASTM 240
Slide/Log and Stiffeners	ASTM B 209/220, Alloy 6061-T6 Aluminum
Anchor Studs, Fasteners and Nuts	ASTM F593/F594, Type 316 Stainless Steel
Invert Seal	Neoprene ASTM D-2000 or EPDM
Seat/Seal and Facing	Ultra-High Molecular Weight Polyethylene ASTM D4020
Storage system structural components	Stainless Steel, Type 316, ASTM 276
Lifting device	ASTM B 209/220, Alloy 6061-T6 Aluminum

B. Stop Logs:

1. Stop log planks shall be fabricated of aluminum plate reinforced with extruded or structural aluminum horizontal and vertical members.

2. All structural components of the frame and slide shall be fabricated of aluminum having a minimum thickness of one-quarter (1/4)-inch and shall have adequate strength to prevent distortion during normal handling, during installation and while in service.

3. The stop logs shall be of the heights indicated on the Contract Drawings or as specified in Section 40 06 20 – Process Pipe, Valve, and Gate Schedules.

4. Maximum bending stress shall not exceed 7,600 psi at maximum operating head or shall not deflect more than 1/360 of the span of the plank under the design head.

5. Planks will be of sufficient weight to be submerged under their own weight.

6. Two slots shall be provided in the top of each stop log for removal and installation via the stop log lifter. Lifting lugs shall be capable of withstanding the lifting load necessary to remove the stop log plank under the field design head.

7. Each stop log shall be outfitted with a stainless steel or aluminum identification tag indicating the manufacturer, width of the opening and maximum head rating at a minimum. Additional tags shall be included on each stop log that indicate “dry side” and “wet side”. Tags shall be welded to each log.

C. Seals:

1. Each stop log plank shall be provided with uninterrupted seals along the bottom of the plank and up both sides. The seals shall be attached to the plank with Type 316 stainless steel bars and fasteners and seals shall be self-adjusting type.

2. The shape of the seal shall provide a seating surface having a minimum width of 1 inch. The vertical face of the seal shall be in contact with the seating surface of the guide to provide a proper seal at the corners. Stop logs that utilize rubber “J” seals or “P” seals are not acceptable.

3. As indicated on the Contract Drawings, the bottom of the plank shall seal against invert mounted plate or wall mounted steel member.

4. Maximum guaranteed leakage: 0.10 gpm/ft of seal length.

5. Frame mounted seals are not acceptable.

D. Frame Guides:

1. The frame guides or grooves and invert member shall be constructed of stainless steel with a minimum thickness of one-quarter (1/4)-inch.

2. Frame design shall allow for embedded mounting or mounting directly to a wall with stainless steel anchor bolts and grout. Mounting style shall be as shown on the Contract Drawings.

3. Gussets shall be provided as necessary to support the guide members at a design head condition. The gussets shall extend to support the outer portion of the frame guides and shall be positioned to ensure that the load is transferred to the anchor bolts.

4. An invert member shall be provided across the bottom of the guides. The invert member shall be of the bottom mounted type.

5. Guides and all necessary attaching bolts and anchor bolts shall be furnished by the stop log plank manufacturer.

E. Lifting Device:

1. Lifting device shall be provided to remove and install the stop log plank as specified herein and shown on the Contract Drawings. The lifters shall be designed to function with provided stop log plank lengths.

2. The lifting device shall be equipped with a suitable eye bolt for portable crane operation. The device shall be oriented in its position by the stop log plank guides and shall be capable of securing and releasing the stop logs with the use of a lanyard from the operating floor.

3. The lifter shall be capable of installing and removing all stop logs of the specified width whether they are installed or at the operating floor level.

4. The lifter shall be capable of installing and removing all stop logs from the operating floor without entry into the associated channel.

F. Stop Log Plank Storage:

1. Furnish and fabricate a complete storage rack system specifically designed for the location indicated on the Contract Drawings.

2. Location and details of storage facilities shall be submitted to the Engineer for approval prior to installation.

3. The system will include suitable shelves and/or hooks to conveniently access all the stop logs of a system sequentially for positioning in the assigned operating location. Stop log identification numbers shall be clearly visible.

4. Provide permanent barriers to prevent galling or corrosion during storage including but not limited to permanently affixed EPDM, Neoprene or UHMW PE liners to prevent metal to metal contact between logs and between the logs and the storage rack when stored.

5. Logs must be stored off the concrete floor.

6. Storage system shall include a storage slot suitable for the lifting device.

G. Stop log plank bottom seals when in storage shall not be compressed

2.03 FABRICATION/ASSEMBLING/FINISHES

A. Mill finish on aluminum. Welds shall be cleaned to provide a uniform finish.

2.04 SOURCE QUALITY CONTROL/ SHOP TESTS

A. Not Used.

PART 3 – EXECUTION

3.01 EXAMINATION / PREPARATION

A. Examination of Stop Log Plank Locations:

1. Contractor shall examine the locations of the stop log planks to verify all pertinent dimensions prior to fabrication of the stop log planks.

2. Contractor shall have full responsibility for the proper fit of the furnished stop log planks at the locations designated on the Contract Drawings.

3.02 INSTALLATION

A. Number, size and location of stop log planks, guides and lifting devices shall be provided as shown on the Contract Drawings or called for in the Contract Documents.

3.03 FIELD TESTING / QUALITY CONTROL

A. Testing of Stop Log Planks:

1. Contractor shall demonstrate, using the stop log puller and lifting device, the ease of installation, removal and the proper fit of the stop log planks at each location where a stop log groove is provided using multiple combinations of stop log planks to demonstrate the interchangeability, fit and leakage performance in the presence of and to the satisfaction of the Engineer.

2. The completely assembled stop log planks shall be tested in place in each location where stop logs and grooves are installed for conformance to the manufacturer's maximum guaranteed leakage rate.

3. Any stop log planks that bind, do not fit, or do not meet leakage requirements shall be repaired and retested all at no additional cost to the owner.

3.04 STARTUP / DEMONSTRATION

A. The stop logs shall be demonstrated to conform to specified requirements.

B. Demonstrate the use of the storage rack system by placing all of the logs into their storage position and then removing them.

3.05 ADJUSTING / PROTECTION / CLEANUP

A. Following successful completion of field tests and demonstration, the Contractor shall thoroughly clean the stop logs and lifter before storing in the storage system.

END OF SECTION

SECTION 40 05 59.23
FABRICATED STAINLESS-STEEL SLIDE GATES

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install all fabricated stainless-steel slide gates complete with all accessories, special tools, spare parts, mountings, anchor bolts and other appurtenances as specified herein, as shown on the Drawings, and as required for a complete and operating installation. The gates and appurtenances shall be supplied in accordance with the latest edition of ANSI/AWWA C561 Fabricated Stainless-Steel Slide Gates, except as modified herein. Leakage shall not exceed 0.05 gallon per minute per foot of wet perimeter, which is half the allowable leakage rate listed in the latest revision of AWWA C561.

B. Equipment shall be provided in accordance with the requirements of Section 46 00 00 – Equipment General Provisions and Section 40 05 00 – Basic Mechanical Requirements.

C. Refer to Section 40 06 20 – Process Pipe, Valve, and Gate Schedules for further detail on gate location, dimensions, design criteria, number required, etc.

D. Manual and electric gate actuators (operators) shall be as specified in Section 40 05 58 – Gate Operators and Electric Gate Actuators.

E. The Contractor shall coordinate all details, locations, clearances, and other conditions with the various equipment suppliers, so that the gates function as part of a complete system.

1.02 WARRANTY

A. Warranty shall be as specified in Section 46 00 00 – Equipment General Provisions.

1.03 SUBMITTALS

A. The following items shall be submitted with the Shop Drawings, in accordance with or in addition to, the submittal requirements specified in Section 01 33 00 – Submittal Procedures and Section 46 00 00 – Equipment General Provisions:

1. Shop drawings showing dimensions, general construction, and materials used for all parts of the gate and gate appurtenances. These drawings shall include sufficient detail to determine if the proposed equipment meets the requirements specified herein and must include individual drawings for each typical gate to be provided.

2. Certification that submitted gates are in accordance with the latest edition of AWWA C561, except as modified herein.

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3. Submit design calculations for approval of the Engineer. Submitted calculations shall be signed and sealed by a New York State Professional Engineer.

    a. Design calculation demonstrating that stresses and deflections are within specified limits.

    b. Design calculation demonstrating anchor bolt sizing and spacing in compliance with AWWA C561.

    c. Design calculation for sizing of gate stem and actuator.

4. Operation and Maintenance Manuals

PART 2 – PRODUCTS

2.01 GENERAL

A. Subject to compliance with the Specifications, provide products manufactured by

1. RW Gate Company,

2. Whipps,

3. Or approved equal.

B. The same manufacturer shall furnish all fabricated stainless-steel slide gate assemblies.

C. The gates and appurtenances shall be designed for installation in the structures shown on the Drawings.

D. Gates shall be configured as indicated in Section 40 06 20 – Process Pipe, Valve, and Gate Schedules.

E. Gates shall be either submerged or free surface gates as indicated in Section 40 06 20 – Process Pipe, Valve, and Gate Schedules.

1. Submerged gates shall be sealed on all 4 sides.

2. Free surface gates shall be sealed on the bottom and both sides.

F. Gates shall be either flush bottom or conventional closure as shown on the Drawings.

G. Gate actuator shall be as identified in Section 40 06 20 – Process Pipe, Valve, and Gate Schedules.

H. Stainless-steel nameplates shall be permanently attached to each pedestal (floor stand), yoke (bench), or torque tube (bench stand), indicating gate invert elevation, the Owner’s

gate tag number per Section 40 06 20 – Process Pipe, Valve, and Gate Schedules, and the Manufacturer's identification number.

I. All welds shall be performed by welders with AWS D1.6 certification

J. Finish: Mill finish on stainless steel. Welds shall be sandblasted to remove weld burn and scale. All iron and steel components shall be properly prepared and shop coated with a primer.

2.02 FRAME AND GUIDES

A. The guides shall be integral with the frame. The frame assembly, including the guide members, invert member, and yoke member, shall be constructed of formed stainless steel plate with a minimum thickness of ¼-inch.

1. The structural portion of the frame that incorporates the seat/seals shall be formed or welded into a one-piece shape for rigidity.

2. Guide members that consist of two or more bolted structural members are not acceptable.

B. Gussets shall be provided as necessary to support the guide members in an unseating head condition. The gussets shall extend to support the outer portion of the guide assembly and shall be positioned to ensure that the load is transferred to the anchor bolts.

C. The guides shall be provided with holes for anchor bolts at a maximum spacing of 18-inches.

2.03 SLIDE AND SEAL

A. The slide (disc) shall be stainless-steel plate reinforced with structural shapes of the same alloy welded to the plate.

B. Slide deflection shall not exceed 1/720 of gate width at maximum design head, or 1/16 in., whichever is less.

C. When the width of the gate opening in feet multiplied by the maximum design head in feet is less than 100 square feet the portion of the slide member that engages the guide shall be 1/4" thick. When the width of the gate opening in feet multiplied by the maximum design head in feet is between 100-140 square feet the portion of the slide member that engages the guide shall be 1/2" thick. When the width of the gate opening in feet multiplied by the maximum design head in feet is greater than 120 square feet, the portion of the slide that engages the guide members shall be 1-1/2" thick or of a structural edge design.

D. All gates shall be provided with a self-adjusting UHMW-PE seal system to restrict leakage in accordance with the requirements listed in this specification.

E. All seals must be bolted or otherwise mechanically fastened to the frame or slide. Arrangement with seals that are force fit or held in place with adhesives are unacceptable.

F. Gates that utilize rubber “J” seals or “P” seals are not acceptable.

2.04 ACTUATOR SUPPORT/MOUNTING

A. Self-contained gates:

1. Self-contained gates shall be provided with a yoke machined to receive either a base-plate or torque tube for actuator mounting.

2. The yoke shall be formed by two (2) angles or channels welded at the top of the guides to provide a one (1) piece rigid frame.

3. The arrangement of the yoke shall be such that the stem and slide can be removed without disconnecting the yoke.

4. At maximum operating load, yoke deflection shall not exceed 1/720 of gate width, or a maximum of ¼-inch, whichever is less. Design the structure with a factor of safety of 5 based on the ultimate tensile, compressive and shear strength of the material.

B. Non-self-contained gates shall have a pedestal mounted to a reinforced concrete slab or reinforced concrete haunch, aligned with the gate stem.

2.05 STEMS AND STEM GUIDES

A. Unless otherwise indicated on the Drawings, all gates shall be rising stem.

B. The threaded portion of the stem shall have a minimum outside diameter of 1-1/2 inches. Stem extension pipes are not acceptable.

C. The threaded portion of the stem shall have machine rolled threads of the full Acme type with a 16 microinch finish or better. Stub threads are not acceptable.

D. Operating stems shall be designed to transmit in compression at least 2-1/2 times the rated output of the operating mechanism with a 40-pound effort on the crank or handwheel, or 2 times the stalled motor torque of the electric actuator, whichever is greater.

E. Stem design calculations shall use the stem minor diameter for calculating stem cross sectional area and stresses due to compression and tension loads.

F. Stems of more than one section shall be joined by stainless steel couplings. The coupling shall be bolted to the stems. Keys or pins shall be stainless steel materials matching the alloy of the gate stem. All threaded and keyed couplings of the same size shall be interchangeable.

G. Gates wider than 48 inches and having a width greater than twice the height shall have dual stems. Any gates not meeting these criteria shall have a single stem unless otherwise designated in Section 40 06 20 – Process Pipe, Valve, and Gate Schedules. Dual stem gates shall be equipped with two lifting mechanisms connected with a jackshaft for synchronization. The jackshaft shall be constructed of the same material as the stems.

H. Stem guides shall be adjustable in two directions and shall be placed according to Manufacturer's recommendation, but in no case shall spacing exceed 10 feet on center. In addition, stem slenderness ratio (l/r) shall not be greater than 200.

I. Rising stem gates shall be provided with an adjustable stop collar on the stem above and below the actuator lift nut. Collars below the nut shall not be required for self-contained gates where the frame height equals the gate height plus the range of travel of the slide.

2.06 MATERIALS

A. Materials for gates shall conform to the following specifications:

Frame Assembly Yoke, and Retainers	Stainless Steel, Type 316L, ASTM A240
Slide and Stiffeners	Stainless Steel, Type 316L, ASTM A240
Stem and Anchor Studs	Stainless Steel, Type 316, ASTM A276
Stem Couplings and Stop Collars	Stainless Steel, Type 316, ASTM A276 or Bronze, ASTM B584 (UNS C87200 or C87300)
Fasteners and Nuts	Stainless Steel, Type 316, ASTM F593/F594 or ASTM A276
Invert Resilient Seal	Neoprene or EPDM, ASTM D-2000
Gate Seat/Seals and Facing	UHMW Polyethylene, ASTM D4020
Non-Rising Stem Thrust Nuts	Bronze, ASTM B584 (UNS C87200 or C87300) or Bronze ASTM B505 (UNS C95800)
Actuator Lift Nuts	Bronze, ASTM B584 (UNS C86300 or C86500) or Bronze ASTM B505 (UNS C95800)
Pedestal and Actuator Wall Brackets	Stainless Steel, Type 316L, ASTM A276
Actuator Housing	Cast Aluminum or Ductile Iron
Stem Guide Brackets	Stainless Steel, Type 316L, ASTM A276

Stem Guide Bushings	UHMW Polyethylene, ASTM D4020

PART 3 – EXECUTION

3.01 MANUFACTURER'S FIELD SERVICES

A. The services of a qualified manufacturer's technical representative shall be provided in accordance with Section 46 00 00 – Equipment General Provisions and shall include the following site visits for the Contract:

Service	Number of Trips	Number of Days/Trip
Installation and Testing	4	1
Startup and Training	1	2
Services after Startup	1	1

3.02 INSTALLATION AND TESTING

A. Installation - The gates shall be set carefully in the locations shown on the Drawings in accordance with the installation manual furnished by the gate manufacturer.

1. The stems shall be provided with wall-mounted guides where required.

2. All gates shall be operated and tested to assure proper installation.

B. Concrete Surface Mounting/Grouting – once gate has been properly anchored per manufacturer's requirements, gate shall be formed and grouted with flowable non-shrink grout per Section 03 60 00 – Grout to fill all voids between gate frame and wall. Dry packing of grout shall not be considered acceptable.

C. Testing - The completely assembled and installed gates shall be inspected for proper seating.

1. The gate slide shall be fully opened and closed in its guide system to ensure that it operates freely.

2. Pedestals shall be shop-operated to ensure proper assembly and operation.

D. All gates shall be certified that at the operating head conditions indicated on the Gate Schedule, leakage shall not exceed 0.05 gallon per minute per foot of wet perimeter.

3.03 PAINTING

A. All ferrous parts, except stainless steel, of the gates and stem guides shall be blast-cleaned and painted in accordance with Section 09 90 00 – Painting.

B. All machined iron surfaces, including drilled and tapped holes, shall be coated with a protective grease.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 40 05 68.23
MISCELLANEOUS VALVES

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Reference Section 40 05 00 – Basic Mechanical Requirements.

PART 2 – PRODUCTS

2.01 SOLENOID VALVES

A. Two-Way (SV-2W)

1. Two-way solenoid valves shall be normally closed and shall open when the solenoid is energized, unless otherwise noted. The valve shall be of forged brass-body and bonnet with a BUNA "N" diaphragm and screwed ends. The solenoid's internal parts shall be of 300 and 400 series stainless steel. The valve shall have a safe body working pressure of 125 psi, and shall be as manufactured by ASCO Valves, Automatic Switch Co., or approved equal, for 120-volt, 60 Hz, single phase operation. Solenoid enclosure shall be NEMA 4 watertight.

2.02 PRESSURE RELIEF, REDUCING AND REGULATING VALVES

A. Pressure Regulating Valve (PRGV)

1. Pressure reducing and regulating valves (water service) 1/2-inch and under shall be bronze and above 1/2-inch shall have cast iron bodies bronze fitted. Valves shall be constructed with full openings and capable of supplying a full flow of water at reduced pressure. Valves shall be so constructed that repairs can be made without removing the valves from the line. The valves shall be equipped with a sedimentation chamber and stainless steel or bronze strainer. Pressure reducing and regulating valves shall be the back pressure sustaining type and shall operate over a range at differential pressures from 5 to 120 psi. Reducing and regulating valves shall meet or exceed the requirements of ASSE 1003 (ANSI A112.26.2) and shall be WATTS model LF25AUB-Z3, Zurn Wilkins model 600XLHTSTSC, or approved equal.

2.03 STRAINERS

A. Y-Strainers shall be Y-pattern cast iron body, flanged or screwed ends with stainless steel or Monel, 20 mesh strainers. Strainers shall be 200 psi, cold-water service strainers, as manufactured by WATTS, Crane Co., Zurn, or approved equal.

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END OF SECTION

NO TEXT ON THIS PAGE

SECTION 40 05 97

PIPING AND EQUIPMENT IDENTIFICATION SYSTEMS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install all components of the system for identification of piping and equipment as specified hereinafter. The system shall include the application of color coding to all new and altered plant piping. The Contractor shall paint the equipment and piping of all Contracts in the colors herein specified, and in accordance with the requirements of Section 09 90 00 – Painting.

B. In addition to the legends specified herein, the Engineer may order the Contractor to furnish and install additional identification legends and arrows at no additional cost to the Owner. Such additional signs may be requested near completion of the work and shall be limited to no more than five (5) signs for each type specified herein. The legends and color combinations for additional signs shall conform to the requirements specified herein.

C. The Contractor shall submit a schedule of the colors and designations proposed in accordance with Section 01 33 00 – Submittal Procedures and this Section. A minimum of four (4) color charts with cross-references to the colors listed herein shall be included with the Submittal.

D. Reference Section 40 05 00 – Basic Mechanical Requirements.

PART 2 – PRODUCTS

2.01 PIPING BAND

A. All new and altered piping shall receive identification bands. Such bands shall be 6-inches wide, neatly made by masking, and spaced at intervals of 30-inches on centers regardless of the diameter of the pipe being painted. The Contractor may use approved precut and prefinished metal bands on piping, in lieu of the masked and painted bands, where approved by the Engineer.

2.02 PIPING IDENTIFICATION LEGEND

A. The Contractor shall apply identification legends to all types and sections of piping as shown on the Drawings or as designated by the Engineer. Such legends shall be in the form of plain block lettering giving the name of the pipe content in full or abbreviated form and showing the direction of flow by arrows. All lettering and arrows shall be of the plastic snap-on type, Seton nameplate "setmarks", or equal, or they shall be formed by stenciling in an approved manner using white or black as directed and shall have an overall height in inches in accordance with the following table:

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Diameter of Pipe or Pipe Covering	Height of Lettering
3/4 to 1-1/4 inches	1/2-inches
1-1/2 to 2-inches	3/4-inches
2-1/2 to 6-inches	1-1/4-inches
8 to 10-inches	2-1/2-inches
Over 10-inches	3-1/2-inches

B. Identification lettering shall be located midway between color coding bands where possible. Identification lettering and arrows shall be placed as directed by the Engineer, but shall generally be located each fifteen (15) feet in pipe length, and shall be properly inclined to the pipe axis to facilitate easy reading. In the event lettering and arrow identifications are required for piping less than 3/4-inch in diameter, the Contractor shall furnish and attach approved color-coded tags where instructed.

C. The colors referenced in the legend are as manufactured by KOP-COAT. They are used for convenience only.

D. Piping and Equipment Identification:

Service	Legend	Base
Sanitary and Process Drains	Drain	Grey
Potable Cold Water	Potable Water	Light Blue
Potable Hot Water	Potable Water-Hot	Light Blue
Nonpotable Water	Nonpotable Water	Light Green
Material Hoisting Equipment	--	Yellow
Fall Protection Equipment	--	Red

PART 3 – EXECUTION (NOT USED)

121311

END OF SECTION

SECTION 40 06 20

PROCESS PIPE, VALVE, AND GATE SCHEDULES

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. Reference Section 40 05 00 - Basic Mechanical Requirements.

1.02 PIPING SCHEDULES

A. Piping requirements for this Section are outlined on the Drawings and in the Piping Schedules. In the absence of a specified test pressure, pipe shall be tested at the greater of: 1) 150 percent of working pressure as determined by the Engineer or 2) 10 psig, unless the Schedule indicates no test is required.

B. If the pipe material is not shown on the Piping Schedule or otherwise specified, the following materials shall be used.

PIPE SIZE	MATERIAL	TYPE OF JOINT	CLASS/DESIGN	TEST PRESSURE
4-IN AND LARGER	DIP	FLANGED (EXPOSED)	CLASS 53	(1)
		RESTRAINED (BURIED)	PRESSURE CLASS 350	
LESS THAN 4-IN	PVC/CPVC (2)	SOCKET	SCH 80	(1)

(1) Test at 150 percent of working pressure or 10 psi, whichever is greater.
(2) For all PVC / CPVC designations, if piping is exposed to direct sunlight or if heat tracing is required, CPVC shall be used. Otherwise, PVC shall be used.

1.03 VALVE SCHEDULES

A. All valves shall be tagged by the manufacturer according to the control valve designations listed in this Section.

B. Valves not listed in this Section shall be manually operated, unless otherwise shown on the Drawings.

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1.04 GATE SCHEDULES

A. Gates shall be tagged by the manufacturer according to locations listed in this Section.

SECTION 40 06 20

PROCESS PIPE, VALVE, AND GATE SCHEDULE

WASTEWATER TREATMENT PLANT PIPING SCHEDULE

PIPE DESIGNATIONS		MATERIAL	BURIED PIPING		EXPOSED PIPING			DESIGN PRESSURE (PSI)[1]			
			TYPE OF JOINT	CLASS/ DESIGN	TYPE OF JOINT	CLASS/ DESIGN	HEAT TRACE[2]	WORKING	SURGE	RESTRAINT	FIELD TEST
DR	PROCESS DRAIN GRAVITY	< 4" PVC / CPVC[3]	SOCKET	SCH 80	SOCKET/ FLANGED	SCH 80	NO	5	5	5	N/A
		> = 4" DIP	RESTRAINED	PRESSURE CLASS 53	FLANGED	CLASS 53	NO				

1) Surge pressure is the maximum pressure in the system during a surge event. Restraint pressure shall be used to determine pipe joint design and if required, the size, number, material, and dimensions of tabs and threaded-rods and thrust blocking for thrust restraint of piping and piping system components specified.
2) Flanges shall be provided as shown on the drawings or as approved by the Engineer.
3) Flanged by grooved adapters shall be used at transitions to equipment or valves that are specified to be flanged.

40 05 59.23 FABRICATED STAINLESS-STEEL SLIDE GATE SCHEDULE (ANSI/AWWA C561)

TAG NO.	DESCRIPTION	SIZE			DESIGN HEAD[1]		SUBMERGED/ FREE SURFACE	OPEN DIRECTION (UP/DOWN)	GATE MOUNT[2]	GATE CONFIG-URATION	DUAL STEM (YES/NO)	ACTUATOR STAND MOUNT	ACTUATOR TYPE
		WIDTH (in.)	HEIGHT (in.)	DIAMETER (in.)	SEATING (ft.)	UN-SEATING (ft.)							
SLG-101	SCREEN INFLUENT CHANNEL 1	60	96	N/A	8	8	FREE SURFACE	UP	CONCRETE (SURFACE) & CONCRETE (EMBEDDED)	SELF-CONTAINED	NO	PEDESTAL	HAND-CRANK
SLG-201	SCREEN INFLUENT CHANNEL 2	60	96	N/A	8	8	FREE SURFACE	UP	CONCRETE (SURFACE)	SELF-CONTAINED	NO	PEDESTAL	HAND-CRANK
SLG-301	SCREEN INFLUENT CHANNEL 3	60	96	N/A	8	8	FREE SURFACE	UP	CONCRETE (SURFACE) & CONCRETE (EMBEDDED)	SELF-CONTAINED	NO	PEDESTAL	HAND-CRANK
SLG-102	SCREEN EFFLUENT CHANNEL 1	60	96	N/A	8	8	FREE SURFACE	UP	CONCRETE (SURFACE)	SELF-CONTAINED	NO	BASE-PLATE	HAND-CRANK
SLG-202	SCREEN EFFLUENT CHANNEL 2	60	96	N/A	8	8	FREE SURFACE	UP	CONCRETE (SURFACE)	SELF-CONTAINED	NO	BASE-PLATE	HAND-CRANK
SLG-302	SCREEN EFFLUENT CHANNEL 3	60	96	N/A	8	8	FREE SURFACE	UP	CONCRETE (SURFACE)	SELF-CONTAINED	NO	BASE-PLATE	HAND-CRANK
SLG-401	SCREEN CHANNEL BYPASS GATE	N/A	N/A	54	18	18	SUBMERGED	UP	CONCRETE (SURFACE) & CONCRETE (EMBEDDED)	SELF-CONTAINED	NO	PEDESTAL	HAND-CRANK

1) Design Head is as measured from the gate invert to the maximum WSEL.
2) See Contract Drawings for additional gate mount details.

STOP LOG SCHEDULE

TAG NO.	DESCRIPTION	SIZE		DESIGN HEAD[1] (ft.)	CHANNEL INVERT TO OPERATING FLOOR (ft.)	NO. OF STOP LOG FRAMES	NO. OF SETS OF STOP LOGS	MOUNTING CONFIGURATION
		WIDTH (in.)	HEIGHT (in.)					
N/A	SCREEN INFLUENT	60	12	10	18	3	1	SURFACE MOUNTED
N/A	SCREEN EFFLUENT	60	12	10	18	3	1	CHANNEL SURFACE MOUNTED
N/A	MANUAL BAR RACK CHANNEL	36	12	7.5	6	2	1	CHANNEL SURFACE MOUNTED

1) Design Head is as measured from the gate invert to the maximum WSEL.

END OF SECTION

SECTION 40 61 13

PROCESS CONTROL SYSTEM GENERAL PROVISIONS

PART 1 – GENERAL

1.01 SCOPE

A. The Contractor shall provide, through the services of an instrumentation and control system subcontractor, components, system installation services, as well as required and specified ancillary services in connection with the Instrumentation, Control and Information System.

B. The System includes materials, labor, tools, fees, charges, and documentation required to furnish, install, test and place in operation a complete and operable instrumentation, control and information system.

C. The system shall include measuring elements, signal converters, transmitters, local control panels, digital hardware and software, operator workstations, remote telemetry units, signal and data transmission systems, interconnecting wiring, and pertinent accessories.

D. The scope of the work to be performed under this Division includes but is not limited to the following:

1. The Contractor shall retain overall responsibility for the instrumentation and control system as specified herein.

2. Furnish and install process instrumentation and associated taps and supports as scheduled or shown on the Drawings, unless otherwise noted or supplied by equipment vendors.

3. Furnish and install local control panels, field panels and associated cabinets and panels as shown on the Drawings and as specified in Sections 40 61 13 through 40 79 00 inclusive and where included.

4. Furnish and install new DIN rail, discrete signal terminal blocks and interpanel wiring in existing PLC-RTU1 panel to interface to new discrete input module.

5. Furnish and install digital control system hardware and software as specified in Sections 40 61 13 through 40 79 00, inclusive and where included. Modify existing PLC-RTU1 by adding a discrete input card and associated terminal blocks to the existing system.

6. Final termination and testing of instrumentation and control system signal wiring, communication cables and power supply wiring at equipment furnished under Sections 40 61 13 through 40 79 00, inclusive and where included.

7. Furnish, install, and terminate special cables for devices (e.g., instruments, printers, radios).

8. Furnish and install surge protection devices for digital equipment, local control panels, and instrumentation provided under this Division, including connections to grounding system(s) provided under Division 26.

9. Coordinate grounding requirements with the electrical subcontractor for digital equipment, local control panels, remote telemetry units, and instrumentation provided under this Division. Terminate grounding system cables at equipment provided under this Division.

10. Update existing PLC-RTU1 source code and OIT graphics to incorporate signals from new field instrumentation and vendor supplied systems as required to monitor and display status for operator information.

11. Provide system testing, calibration, training and startup services as specified herein and as required to make systems fully operational.

12. Final termination and testing of instrumentation and control systems signal wiring to existing remote terminal unit panel from equipment and instruments furnished under other sections and as shown on contract drawings and specifications. Existing remote terminal unit hardware and software to be modified as required for additional signals, displays and functions provided by newly installed equipment.

E. It is the intent of the Contract Documents to construct a complete and working installation. Items of equipment or materials that may reasonably be assumed as necessary to accomplish this end shall be supplied whether or not they are specifically stated herein.

1.02 RELATED ITEMS

A. Field mounted switches, torque switches, limit switches, gauges, valve and gate operator position transmitters, sump pump controls, and other instrumentation and controls furnished with mechanical or electrical equipment not listed in the instrument schedule shall be furnished, installed, tested, and calibrated as specified under other Divisions unless otherwise indicated.

B. Additional and related work performed under Division 26 includes the following:

1. Instrument A.C. power source and disconnect switch for process instrumentation, A.C. grounding systems, and A.C. power supplies for equipment, control panels and accessories furnished under Sections 40 60 00 through 40 79 99, inclusive and where included.

2. Conduit and raceways for instrumentation and control system signal wiring, grounding systems, special cables and communication network cables.

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3. Instrumentation and control system signal wiring.

4. Install control system communication network cables.

5. Furnish and install grounding systems for digital equipment, local control panels, remote telemetry units, and instrumentation provided under Sections 40 60 00 through 40 79 99, inclusive and where included. Grounding systems shall be complete to the equipment provided under Sections 40 60 00 through 40 79 99, inclusive, and where included, ready for termination by the instrumentation subcontractor.

6. Termination of instrumentation and control system signal wiring at equipment furnished under other Divisions of the Specifications.

7. Final wiring and termination to A.C. grounding systems and to A.C. power sources (e.g., panelboards, motor control centers, and other sources of electrical power).

1.03 GENERAL INFORMATION AND DESCRIPTION

A. Where manufacturers are named for a particular item of equipment, it is intended as a guide to acceptable quality and performance and does not exempt such equipment from the requirements of these Specifications or Drawings.

B. In order to centralize responsibility, it is required that equipment (including field instrumentation and control system hardware and software) offered under this Division shall be furnished and installed by the instrumentation subcontractor, or under the supervision of the instrumentation subcontractor, who shall assume complete responsibility for proper operation of the instrumentation and control system equipment, including that of coordinating signals, and furnishing appurtenant equipment.

C. The Contractor shall retain total responsibility for the proper detailed design, fabrication, inspection, test, delivery, assembly, installation, activation, checkout, adjustment and operation of the entire instrumentation and control system as well as equipment and controls furnished under other Divisions of the Specifications. The Contractor shall be responsible for the delivery of detailed drawings, manuals and other documentation required for the complete coordination, installation, activation and operation of mechanical equipment, equipment control panels, local control panels, field instrumentation, control systems and related equipment/systems and shall provide for the services of a qualified installation engineer to supervise activities required to place the completed facility in stable operation under full digital control.

D. The instrumentation and control system shall be capable of simultaneously implementing all real time control and information system functions, and servicing all operator service requests as specified, without degrading the data handling and processing capability of other system components.

E. Control system inputs and outputs are listed in Section 40 61 93 – Process Control System Input/Output List. This information, together with the functional control descriptions, process and instrumentation diagrams, and electrical control schematics, describes the real time monitoring and control functions to be performed. In addition, the system shall provide various man/machine interface and data reporting functions as specified in the software Sections of this Specification.

F. The mechanical, process, and electrical drawings indicate the approximate locations of field instruments, control panels, systems and equipment as well as field mounted equipment provided by others. The instrumentation subcontractor shall examine the mechanical, process and electrical drawings to determine actual size and locations of process connections and wiring requirements for instrumentation and controls furnished under this Contract. The instrumentation subcontractor shall inspect equipment, panels, instrumentation, controls, and appurtenances, either existing or furnished on the Project to determine requirements for interfacing with the control and information system. The Contractor shall coordinate the completion of required modifications with the associated supplier of the item furnished.

G. The instrumentation subcontractor shall review and approve the size and routing of instrumentation and control cable and conduit systems furnished by the electrical subcontractor for suitability for use with the associated cable system.

H. The Contractor shall coordinate the efforts of each supplier to aid in interfacing systems. This effort shall include, but shall not be limited to, the distribution of approved shop drawings to the electrical subcontractor and to the instrumentation subcontractor furnishing the equipment under this Division.

I. The Contractor shall be responsible for providing a signal transmission system free from electrical interference that would be detrimental to the proper functioning of the instrumentation and control system equipment.

J. The Owner shall have the right of access to the subcontractor's facility and the facilities of his equipment suppliers to observe materials and parts; witness inspections, tests and work in progress; and examine applicable design documents, records, and certifications during all stages of design, fabrication, and tests. The instrumentation subcontractor and his equipment suppliers shall furnish office space, supplies, and services required for these observation activities.

K. The terms "Instrumentation," "Instrumentation and Control System," and "Instrumentation, Control and Information System" shall hereinafter be defined as equipment, labor, services, and documents necessary to meet the intent of the Specifications.

1.04 INSTRUMENTATION AND CONTROL SYSTEM SUBCONTRACTORS

A. Contractor shall investigate and verify manufacturer, model and revision of the Owner's existing Network, PLC, and HMI hardware and software and as well as the number, design and complexity of relevant displays, alarm summary pages, data collection and trending/reporting to ensure subcontractor familiarity with the control system environment prior to bid.

B. Instrumentation and control system subcontractors shall be regularly engaged in the detailed design, fabrication, installation, calibration, PLC programming, OIT graphic programming, and startup of instrumentation and control systems for wastewater treatment facilities. Instrumentation and control system subcontractors shall have a minimum of five years of such experience and shall have completed a minimum of three projects of similar type and size as that specified herein. Where specific manufacturers/models of major hardware or software products (PLC, HMI software, network, etc.) are specified to be used on this project, the instrumentation and control system subcontractor shall have completed at least one project using that specified hardware or software. As used herein, the term "completed" shall mean that a project has been brought to final completion and final payment has been made.

1.05 DEFINITIONS

A. Solid State: Wherever the term solid state is used to describe circuitry or components in the Specifications, it is intended that the circuitry or components shall be of the type that convey electrons by means of solid materials such as crystals or that work on magnetic principles such as ferrite cores. Vacuum tubes, gas tubes, slide wires, mechanical relays, stepping motors or other devices will not be considered as satisfying the requirements for solid state components of circuitry.

B. Bit or Data Bit: Whenever the terms bit or data bit are used in the Specification, it is intended that one bit shall be equivalent to one binary digit of information. In specifying data transmission rate, the bit rate or data bit rate shall be the number of binary digits transmitted per second and shall not necessarily be equal to either the maximum pulse rate or average pulse rate.

C. Integrated Circuit: Integrated circuit shall mean the physical realization of a number of circuit elements inseparably associated on or within a continuous body to perform the function of a circuit.

D. Mean Time Between Failures (MTBF): The MTBF shall be calculated by taking the number of system operating hours logged during an arbitrary period of not less than six months and dividing by the number of failures experienced during this period plus one.

E. Mean Time to Repair (MTTR): The MTTR shall be calculated by taking the total system down time for repair over an arbitrary period of not less than six months coinciding with

that used for calculation of MTBF and dividing by the number of failures causing down time during the period.

F. Availability: The availability of a non-redundant device or system shall be related to its MTBF and MTTR by the following formula:

$$A = 100 \times (MTBF / (MTBF + MTTR)) \text{ Percent}$$

The availability of a device or system provided with an automatically switched backup device or system shall be determined by the following formula:

$$A = A2 + 1 - ((1 - A1) * (1 - A1))$$

where:

A1 = availability of non-redundant device or system

A2 = availability of device or system provided with an automatically switched backup device or system

G. Abbreviations: Specification abbreviations include the following:

1. A - Availability
2. ADC - Analog to Digital Converter
3. AI - Analog Input
4. AO - Analog Output
5. AVAIL - Available
6. BCD - Binary Coded Decimal
7. CSMA/CD - Carrier Sense Multiple Access/Collision Detect
8. CPU - Central Processing Unit
9. CRC - Cyclic Redundancy Check
10. CS - Control Strategy
11. DAC - Digital to Analog Converter
12. DBMS - Data Base Management System
13. DI - Discrete Input

14. DMA - Direct Memory Access
15. DO - Discrete Output
16. DPDT - Double Pole, Double Throw
17. DVE - Digital to Video Electronics
18. EPROM - Erasable, Programmable Read Only Memory
19. FDM - Frequency Division Multiplexing
20. FSK - Frequency Shift Keyed
21. HMI - Human Machine Interface (Software)
22. I/O - Input/Output
23. LAN - Network and Communication Equipment
24. LCD - Liquid Crystal Display
25. LDFW - Lead Follow
26. MCC - Motor Control Center
27. MTBF - Mean Time Between Failures
28. MTTR - Mean Time to Repair
29. OS - Operating System
30. PAC - Programmable Automation Controller
31. PCB - Printed Circuit Board
32. PID - Proportional Integral and Derivative Control
33. PLC - Programmable Logic Controller or Programmable Controller
34. PROM - Programmable Read Only Memory
35. RAM - Random Access Memory
36. RDY - Ready
37. RMSS - Root Mean Square Summation
38. RNG - Running

39. ROM - Read Only Memory

40. RTU - Remote Telemetry Unit

41. SPDT - Single Pole, Double Throw

42. ST/SP - Start/Stop

43. TDM - Time Division Multiplexing

44. UPS - Uninterruptible Power Supply

45. VFD - Variable Frequency Drive

H. To minimize the number of characters in words used in textual descriptions on displays, printouts and nameplates, abbreviations may be used subject to the Engineer's approval. If a specified abbreviation does not exist for a particular word, an abbreviation may be generated using the principles of masking and or vowel deletion. Masking involves retaining the first and last letters in a word and deleting one or more characters (usually vowels) from the interior of the word.

1.06 ENVIRONMENTAL CONDITIONS

A. Instrumentation equipment and enclosures shall be suitable for ambient conditions specified. All system elements shall operate properly in the presence of telephone lines, power lines, and electrical equipment.

B. Inside control rooms and climate-controlled electrical rooms, the temperature will normally be 20 to 25 degrees C; relative humidity 40 to 80 percent without condensation and the air will be essentially free of corrosive contaminants and moisture. Appropriate air filtering shall be provided to meet environmental conditions (e.g., dust).

C. Other indoor areas may not be air conditioned/heated; temperatures may range between 0 and 40 degrees C with relative humidity between 40 and 95 percent.

D. Field equipment including instrumentation and panels may be subjected to wind, rain, lightning, and corrosives in the environment, with ambient temperatures from -20 to 40 degrees C and relative humidity from 10 to 100 percent. All supports, brackets, interconnecting hardware, and fasteners shall be aluminum, type 316 stainless steel, or metal alloy as otherwise suitable for chemical resistance within chemical feed/storage areas shown on the installation detail drawings.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 SCHEDULE OF PAYMENT

A. Payment to the Contractor for Control and Information System materials, equipment, and labor shall be in accordance with the General and Supplementary Conditions. The schedule of values submitted as required by the General and Supplementary Conditions shall reflect a breakdown of the work required for completion of the Control and Information System. The breakdown shall include sufficient detail to permit the Engineer to administer payment for the Control and Information System.

B. Any balance remaining within the schedule of values for field instruments and other materials installed on the site, or for other materials for which payment is made by invoice, will be considered due upon completion of the Final Acceptance test.

3.02 CLEANING

A. The Contractor shall thoroughly clean soiled surfaces of installed equipment and materials.

B. Upon completion of the instrumentation and control work, the Contractor shall remove surplus materials, rubbish, and debris that has accumulated during the construction work. The entire area shall be left neat, clean, and acceptable to the Owner.

3.03 FINAL ACCEPTANCE

A. Final acceptance of the Instrumentation, Control and Information System will be determined complete by the Engineer, and shall be based upon the following:

1. Receipt of acceptable start up completion and availability reports and other documentation as required by the Contract Documents.

2. Completion of the Availability Demonstration.

3. Completion of control system training requirements.

4. Completion of punch-list items that are significant in the opinion of the Engineer.

B. Final acceptance of the System shall mark the beginning of the warranty period.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 40 61 15

PROCESS CONTROL SYSTEM SUBMITTALS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall submit for review complete Shop Drawings for all equipment in accordance with the General and Supplemental Conditions and Division 01 of the Specifications. All submittal material shall be complete, legible, and reproducible, and shall apply specifically to this project.

B. All submittal materials shall be tailored to this project by highlighting relevant items or crossing out non-applicable items. Generic submittals without identified options will be returned the Contractor without review.

C. Compliance, Deviations, and Exceptions (CD&E) Letter:

1. Where a named manufacturer and product is specified and a substitution or an “or equal” product is submitted, the submittal shall be accompanied by a “Compliance, Deviations, and Exceptions (CD&E) letter.” If the required submittal is submitted without the letter, the submittal will be rejected.

2. The letter shall include all comments, deviations and exceptions taken to the Drawings and Specifications by the Contractor, subcontractor (if applicable), and the equipment Manufacturer/Supplier. This letter shall include a copy of the Specification Section to which the submittal pertains. In the left margin beside each and every paragraph/item, a letter "C", "D", or "E" shall be typed or written in.

    a. The letter "C" shall be for full compliance with the requirement.

    b. The letter "D" shall be for a deviation from the requirement.

    c. The letter "E" shall be for taking exception to a requirement.

3. Any requirements with the letter "D" or "E" beside them shall be provided with a full typewritten explanation of the deviation/exception. Handwritten explanation of the deviations/exceptions shall not be acceptable.

4. The CD&E letter shall also address deviations, and exceptions taken to each Drawing related to this Specification Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 33 00 – Submittal Procedures

B. Section 40 61 13 – Process Control System General Provisions

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1.03 EXISTING CONDITIONS / AS-BUILT DOCUMENTATION SUBMITTAL

A. Prior to modifying, demolishing, removing, or decommissioning equipment, thoroughly investigate and document the existing conditions. Please note that Owner's record drawings alone are not sufficient for documentation. The record drawings, if present, shall be verified in the field prior to submitting. Submit drawings, markup, sketches, information, or other materials for documenting the following existing conditions:

1. All I/O on PLC modules that have its wiring modified or new I/O terminated or for any PLC that is being decommissioned/removed/demolished. Document module number, point number, wire numbers, terminal numbers, destination, and function.

2. All wiring entering or leaving a PLC that is being decommissioned, removed, or demolished that is not otherwise accounted for.

B. When all information has been gathered, it shall be submitted to Engineer along with a clear and unequivocal statement that the existing conditions have been documented and understood. Contractor shall be held responsible for all issues that arise due to Contractor's modifications, demolition, removal, or decommissioning of existing equipment, including necessary reversion back to previous conditions.

1.04 DIGITAL HARDWARE SUBMITTALS

A. Submit system block diagram(s) showing:

1. All equipment to be provided.

2. All interconnecting cable.

3. Equipment names, manufacturer, and model numbers.

4. Equipment locations.

B. Submit information for all digital equipment including, but not limited to, the following:

1. Bill of materials with equipment names, manufacturers, complete model numbers and locations.

2. Catalog cuts, including complete part number breakdown information.

3. Complete technical, material and environmental specifications.

4. Assembly drawings.

5. Mounting requirements.

6. Color samples.

7. Nameplates.

8. Environmental requirements during storage and operation.

1.05 SOFTWARE SUBMITTALS

A. Software submittals shall include the following as a minimum:

1. Bill of materials with software names, vendors, and complete listings of included software modules.

2. Standard manufacturer's literature describing the products.

3. Description of function of software in Control and Information System.

4. Limitations or constraints of software.

5. Minimum system (processor and memory) requirements.

6. Operation and maintenance requirements.

B. Submit information on the following software:

1. Third-party software, including:

a. Operating system.

b. Operator workstation (SCADA or HMI) software, including all add-in software provided to perform specific functions (alarm dialers, schedulers, backup creation software, etc.).

c. Office-type products, such as spreadsheets, word processors, etc.

d. Database management software.

e. Communication software, including all applicable local and wide area network software.

f. Programmable controller programming software (where applicable).

2. Software configuration, including:

a. Graphic display organization.

b. Database configuration for operator workstations and database management system.

c. Trends.

d. System security.

e. Formats for all reports, including all required calculations.

f. Intercommunications between software products required to implement system functions.

g. Equipment backup configuration and requirements.

C. Control Strategies

1. Description of automatic logic and all non-standard manual logic using plain English, for non-technical persons, and written in Contractor's own words. The write-up shall include references to associated I/O, tag/loop numbers, alarming/interlocks.

2. Submitting language verbatim to Section 40 61 96 – Process Control Descriptions shall not be acceptable.

D. Application Software

1. Provide application software documentation that contains program descriptions for the operation, modification, and maintenance of all application programs provided for the digital system.

2. Application software includes all custom routines developed specifically for this project, or pre-written routines used for accomplishing specified functions for this project. This shall include any add-in custom software.

E. Graphic Displays

1. Submit all graphic displays required to perform the control and operator interface functions specified herein. Submitted graphic displays shall be for both new and modified graphics.

2. Submit the complete set of graphic displays for review by the Owner and the Engineer at least 60 days prior to commencement of factory testing.

3. Where a large number of graphic displays are required, submit an initial set of example displays for review before the complete set of displays is submitted. This initial set shall include examples of all basic graphic display design features and parameters and is intended to allow the Contractor to obtain preliminary approval of these features and parameters prior to beginning main graphic display production.

4. The Contractor shall allow for one major cycle of revisions to the displays prior to factory testing and one minor cycle of revisions following factory test. A cycle of

revisions shall be defined as all revisions necessary to complete a single set of changes marked by the Engineer and the Owner. Additional corrections shall be performed during start-up as required to accommodate changes required by actual field conditions, at no additional cost to the Owner.

5. The required submittals in each revision cycle shall be full color prints of the entire set of displays.

6. Displays shall be printouts of actual process graphics implemented in the system.

1.06 CONTROL PANEL SUBMITTALS

A. Submittals shall be provided for all control panels, and shall include:

1. Exterior panel drawings with front and side views, to scale.

2. Interior layout drawings showing the locations and sizes of all equipment and wiring mounted within the cabinet, to scale.

3. Panel area reserved for cable access and conduit entry.

4. Location plans showing each panel in its assigned location.

B. Submit information for all exterior and interior panel mounted equipment including, but not limited to, the following:

1. Bill of materials with equipment names, manufacturers, complete model numbers and locations.

2. Catalog cuts, including complete part number breakdown information.

3. Complete technical, material and environmental specifications.

4. Assembly drawings.

5. Mounting requirements.

6. Color samples.

7. Nameplates.

8. Environmental requirements during storage and operation.

C. Submit panel wiring diagrams showing power, signal, and control wiring, including surge protection, relays, courtesy receptacles, lighting, wire size and color coding, etc.

1.07 INSTRUMENT SUBMITTALS

A. Submit information on all field instruments, including but not limited to the following:

1. Product (item) name and tag number used herein and on the Contract Drawings.
2. Catalog cuts, including complete part number breakdown information.
3. Manufacturer's complete model number.
4. Location of the device.
5. Input output characteristics.
6. Range, size, and graduations.
7. Physical size with dimensions, NEMA enclosure classification, and mounting details.
8. Materials of construction of all enclosures, wetted parts and major components.
9. Instrument or control device sizing calculations where applicable.
10. Certified calibration data on all flow metering devices.
11. Environmental requirements during storage and operation.
12. Associated surge protection devices.
13. Installation drawings/details.

1.08 WIRING AND LOOP DIAGRAMS

A. Submit interconnection wiring and loop diagrams for all panels and signals in the Control and Information System.

B. Electrical interconnection diagrams shall show all terminations of equipment, including terminations to equipment and controls furnished under other Divisions, complete with equipment and cable designations. Where applicable, interconnection wiring diagrams shall be organized by input/output card. Interconnecting diagrams shall be prepared in a neat and legible manner on 11 X 17-inch reproducible prints.

C. Loop drawings shall conform to the latest version of ISA Standards and Recommended Practices for Instrumentation and Control. Loop Drawings shall conform to ISA S5.4, Figures 4-6, Minimum Required Items.

D. Loop drawings shall not be required as a separate document provided that the interconnecting wiring diagrams required in Paragraph B., above, contain all information required by ISA 5.4.

1.09 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall deliver equipment operation and maintenance manuals in compliance with Section 01 33 00 – Submittal Procedures. Operation and maintenance (O&M) manuals shall consist of two basic parts:

1. Manufacturer standard O&M manuals for all equipment and software furnished under this Division.

2. Custom O&M information describing the specific configuration of equipment and software, and the operation and maintenance requirements for this particular project.

B. The manuals shall contain all illustrations, detailed drawings, wiring diagrams, and instructions necessary for installing, operating, and maintaining the equipment. The illustrated parts shall be numbered for identification. All modifications to manufacturer standard equipment and/or components shall be clearly identified and shown on the drawings and schematics. All information contained therein shall apply specifically to the equipment furnished and shall only include instructions that are applicable. All such illustrations shall be incorporated within the printing of the page to form a durable and permanent reference book.

C. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc. that are required to instruct operation and maintenance personnel unfamiliar with such equipment. The maintenance instructions shall include troubleshooting data and full preventive maintenance schedules. The instructions shall be bound in locking 3-D-ring binders with bindings no larger than 3.5 inches. The manuals shall include 15% spare space for the addition of future material. The instructions shall include drawings reduced or folded and shall provide the following as a minimum.

1. A comprehensive index.

2. A functional description of the entire system, with references to drawings and instructions.

3. A complete "as built" set of all approved shop drawings, which shall reflect all work required to achieve final system acceptance.

4. A complete list of the equipment supplied, including serial numbers, ranges, and pertinent data.

5. Full specifications on each item.

6. Detailed service, maintenance, and operation instructions for each item supplied.

7. Special maintenance requirements particular to this system shall be clearly defined, along with special calibration and test procedures.

8. Complete parts lists with stock numbers and name, address, and telephone number of the local supplier.

9. References to manufacturers' standard literature where applicable.

10. Warning notes shall be located throughout the manual where such notes are required to prevent accidents or inadvertent misuse of equipment.

D. The operating instructions shall clearly describe the step by step procedures that must be followed to implement all phases of all operating modes. The instructions shall be in terms understandable and usable by operating personnel and maintenance crews and shall be useful in the training of such personnel.

E. The maintenance instructions shall describe the detailed preventive and corrective procedures required, including environmental requirements during equipment storage and system operation, to keep the System in good operating condition. All hardware maintenance documentation shall make reference to appropriate diagnostics, where applicable, and all necessary wiring diagrams, component drawings and PCB schematic drawings shall be included.

F. The hardware maintenance documentation shall include, as a minimum, the following information:

1. Operation Information: This information shall include a detailed description of how the equipment operates and a block diagram illustrating each major assembly in the equipment.

2. Preventive Maintenance Instructions: These instructions shall include all applicable visual examinations, hardware testing and diagnostic routines, and the adjustments necessary for periodic preventive maintenance of the System.

3. Corrective Maintenance Instructions: These instructions shall include guides for locating malfunctions down to the card replacement level. These guides shall include adequate details for quickly and efficiently locating the cause of an equipment malfunction and shall state the probable source(s) of trouble, the symptoms, probable cause, and instructions for remedying the malfunction.

4. Parts Information: This information shall include the identification of each replaceable or field repairable component. All parts shall be identified on a list in a drawing; the identification shall be of a level of detail sufficient for procuring any repairable or replaceable part. Cross references between equipment numbers and manufacturer's part numbers shall be provided.

G. Software documentation shall conform to a standard format and shall include, but not be limited to, the following:

1. A program abstract that includes:

a. Program Name - The symbolic alphanumeric program name.

b. Program Title - English text identification.

c. Program Synopsis - A brief text shall be provided that specifies the need for the program, states when it shall be used and functionally describes all inputs, outputs and functions performed. This descriptive text shall be written in a language that is understandable by non-programming-oriented readers.

2. A program description that shall include, but not be limited to, the following:

a. Applicable Documents - List all documents (standard manufacturer's literature, other program descriptions, etc.) by section, if practical, that apply to the program. One complete copy of all applicable reference material shall be provided.

b. Input Output - Identify each input and output parameter, variable, and software element used by the program. State the purpose of all inputs, outputs, and variables.

c. Processing - This Section shall contain a description of the overall structure and function of the program. Describe the program run stream and present a detailed description of how the program operates. Describe the timing and sequencing of operations of the program relative to other programs. Describe all interactions with other programs. Processing logic that is not readily described without considerable background information shall be handled as a special topic with references to an appendix or to control strategy document that details the necessary information. Reference shall also be made to an appendix or control strategy document for equation and program algorithm derivations.

d. System Configuration - Describe in detail the system configuration or status required for program implementation, if appropriate.

e. Limitations and Constraints - Summarize all known or anticipated limitations of the program, if appropriate.

f. Storage - Define program storage requirements in terms of disk or RAM memory allocation.

g. Verification - Describe, as a minimum, a test that can be used by the operator to assure proper program operation. Define the required system configuration, input requirements and criteria for successful test completion.

h. Diagnostics - Describe all program diagnostics, where applicable. Descriptions shall list each error statement, indicate clearly what it means, and specify what appropriate actions should be taken.

i. Malfunction Procedures - Specify procedures to follow for recovering from a malfunction due to either operator error or other sources.

1.10 FINAL SYSTEM DOCUMENTATION

A. All documentation shall be delivered to the Owner prior to final system acceptance in accordance with the Contract Documents. As a minimum, final documentation shall contain all information originally part of the control system submittals.

B. Provide a complete set of detailed electrical interconnection diagrams required to define the complete instrumentation and control system. All diagrams shall be 11 X 17-inch original reproducible prints. All diagrams shall be corrected to describe final "as built" hardware configurations and to reflect the system configuration and control methodology adopted to achieve final system acceptance.

C. Provide system software documentation for the operation and maintenance of all system software programs provided as a part of the digital system. All system software documentation shall be amended as required to delineate all modifications and to accurately reflect the final as built software configurations.

D. Provide application software documentation that contains program descriptions for the operation, modification, and maintenance of all application programs provided for the digital system.

E. Provide control strategy documentation which shall include control strategy (block oriented or ladder logic) diagrams to describe the control of all processes. Control strategy documentation shall reflect the system configuration and control methodology adopted to achieve final system acceptance. Control strategy documentation shall conform to the submittal requirements listed hereinabove.

F. O&M documentation shall be amended with all final, adjusted values for all setpoints and other operating parameters for Owner reference.

G. The Owner recognizes the fact that not all possible problems related to real time events, software interlocks, and hardware maintenance and utilization can be discovered during the Acceptance Tests. Therefore, the instrumentation subcontractor through the Contractor shall investigate, diagnose, repair, update, and distribute all pertaining documentation of the deficiencies that become evident during the warranty period. All

such documentation shall be submitted in writing to the Owner within 30 days of identifying and solving the problem.

1.11 PROGRAMS AND SOURCE LISTINGS

A. Provide one copy of all standard, of-the-shelf system and application software (exclusive of firmware resident software) on original media furnished by the software manufacturer.

B. Provide one copy of source listings on digital media, acceptable to Engineer, for all custom software/logic written specifically for this facility, all database files configured for this facility, and all control strategies. All source listings shall include a program abstract, program linkage and input/output data. Comments describing the program flow shall be frequently interspersed throughout each listing.

C. All software/logic shall be in both its native format and in Adobe Portable Document Format.

1.12 SUBMITTAL/DOCUMENTATION FORMAT

A. All drawing-type submittals and documentation shall be rendered and submitted in the latest version of AutoCAD.

B. All textual-type submittals and documentation shall be rendered and submitted in the latest version of Microsoft Word or in searchable Adobe Portable Document Format (PDF). Raster scans will not be accepted.

1.13 ELECTRONIC O&M MANUALS

A. Subject to acceptance by the Engineer, the O&M information may be submitted in part or in whole in an electronic format on digital media.

B. Electronic O&M manuals shall contain information in standard formats (searchable Adobe PDF, Word, AutoCAD, HTML, etc.) and shall be easily accessible using standard, “off-the-shelf” software such as an Internet browser. Raster scans will not be accepted.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 40 61 21
PROCESS CONTROL SYSTEM TESTING

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall test the Control and Information System as specified herein to demonstrate compliance with the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 40 61 13 – Process Control System General Provisions

B. Section 40 61 21.72 – Field Testing

C. Section 40 61 21.73 – Final Acceptance Test

1.03 SUBMITTALS

A. For each of the specified tests, submit a test plan to the Engineer at least one month in advance of commencement of the tests. The test plan shall contain the following at a minimum:

1. A schedule of all testing to be conducted.

2. A brief description of the testing to be performed

3. Test objectives.

4. Testing criteria per the Specifications.

5. Check lists and procedures for performing each of the specified tests.

6. Sample test result documentation.

7. Requirements for other parties.

1.04 GENERAL REQUIREMENTS

A. All system start-up and test activities shall follow detailed test procedures; check lists, etc., previously approved by the Engineer. The Engineer shall be notified at least 21 days in advance of any system tests and reserves the right to have his and/or the Owner's representatives in attendance.

B. The Contractor shall provide the services of experienced factory trained technicians, tools and equipment to field calibrate, test, inspect, and adjust all equipment in accordance with manufacturer's specifications and instructions.

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C. The Contractor (or designee) shall maintain master logbooks for each phase of installation, startup and testing activities specified herein. Each logbook shall include signal, loop or control strategy tag number, equipment identification, description and space for sign-off dates, Contractor signature and Engineer signature. Example test documentation specific to each phase of testing shall be approved prior to initiation of that testing, as specified hereinabove.

D. All test data shall be recorded on test forms, previously approved by the Engineer. When each test has been successfully completed, a certified copy of all test results shall be furnished to the Engineer together with a clear and unequivocal statement that all specified test requirements have been met and that the system is operating in accordance with the Contract Documents.

E. The Engineer will review test documentation in accordance with the Contract Documents and will give written notice of the acceptability of the tests within 10 days of receipt of the test results.

F. All testing shall include time for unstructured testing where Owner and Engineer shall have access to the equipment for testing previously undefined normal and abnormal aspects, situations, and functions. Contractor or his/her designee shall provide assistance during this time, including but not limited to documenting the unstructured testing. Owner's and Engineer's unstructured testing scenarios may not be available prior to the testing period.

G. If, in the Engineer's or Owner's opinion, Contractor is not ready for witness testing and Engineer is present, Contractor shall reimburse Owner for Engineer's labor to attend the test. Witness testing shall then be rescheduled, with sufficient notice. In the event that Engineer has traveled, even if only to the project-site, for the testing, Engineer's travel costs shall also be reimbursed. In the event that the Owner has traveled for the testing, Owner's travel costs shall also be reimbursed.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 40 61 21.72
FIELD TESTING

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall perform field testing on the Control and Information System as specified herein to demonstrate compliance with the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 40 61 13 – Process Control System General Provisions

B. Section 40 61 21 – Process Control System Testing

C. Section 40 61 21.73 – Final Acceptance Test

D. Section 40 70 00 – Instrumentation for Process Systems

1.03 GENERAL REQUIREMENTS

A. Control system start-up and testing shall be performed to ensure that all plant processes shall be systematically and safely placed under digital control in the following order:

1. Primary elements such as transmitters and switch devices shall be calibrated and tested as specified in Section 40 70 00 – Instrumentation for Process Systems.

2. Each final control element shall be individually tested as specified hereinafter.

3. Each control loop shall be tested as specified hereinafter.

4. Each control strategy shall be tested under automatic digital control as specified hereinafter.

5. The entire control system shall be tested for overall monitoring, control, communication, and information management functions, and demonstrated for system availability as specified hereinafter.

B. System start-up and test activities shall include the use of water, if necessary, to establish service conditions that simulate, to the greatest extent possible, normal operating conditions in terms of applied process loads, operating ranges and environmental conditions.

C. Each phase of testing shall be fully and successfully completed and all associated documentation submitted and approved prior to the next phase being started. Specific exceptions are allowed if written approval has been obtained in advance from the Engineer.

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1.04 CONTRACTOR'S RESPONSIBILITIES

A. The Contractor shall ensure that all mechanical equipment, equipment control panels, local control panels, field instrumentation, control system equipment and related equipment and/or systems are tested for proper installation, adjusted and calibrated on a loop-by-loop basis prior to control system startup to verify that each is ready to function as specified. Each test shall be witnessed, dated and signed off by both the Contractor (or designee) and the Engineer upon satisfactory completion.

B. The Contractor shall be responsible for coordination of meetings with all affected trades. A meeting shall be held each morning to review the day's test schedule with all affected trades. Similarly, a meeting shall be held each evening to review the day's test results and to review or revise the next day's test schedule as appropriate.

C. The Contractor shall ensure that the electrical subcontractor conforms to the start-up, test and sign-off procedures specified herein to assure proper function and coordination of all motor control center control and interlock circuitry and the transmission of all discrete and/or analog signals between equipment furnished by the electrical subcontractor and the control system specified herein.

D. The Contractor shall ensure that the HVAC subcontractor conforms to the start-up, test and sign-off procedures specified herein to assure proper function of all HVAC system control and interlock circuitry and the transmission of all discrete and/or analog signals between HVAC equipment and controls and the control system specified herein.

1.05 FINAL CONTROL ELEMENT TESTING

A. The proper control of all final control elements shall be verified by tests conducted in accordance with the requirements specified herein.

B. All modulating final control elements shall be tested for appropriate speed or position response by applying power and input demand signals, and observing the equipment for proper direction and level of reaction. Each final control element shall be tested at 0, 25, 50, 75, and 100 percent of signal input level and the results checked against specified accuracy tolerances. Final control elements, such as VFDs, that require turndown limits shall be initially set during this test.

C. All non-modulating final control elements shall be tested for appropriate position response by applying and simulating control signals, and observing the equipment for proper reaction.

1.06 LOOP CHECKOUT

A. Prior to control system startup and testing, each monitoring and control loop shall be tested on an individual basis from the primary element to the final element, including the operator workstation or loop controller level, for continuity and for proper operation and calibration.

B. Signals from transducers, sensors, and transmitters shall be utilized to verify control responses. Simulated input data signals may be used subject to prior written approval by the Engineer. All modes of control shall be exercised and checked for proper operation.

C. The accuracy of all DACs shall be verified by manually entering engineering unit data values at the operator workstation and then reading and recording the resulting analog output data.

D. The accuracy of all ADCs shall be verified using field inputs or by manually applying input signals at the final controller, and then reading and recording the resulting analog input data at the operator workstation.

E. Each loop tested shall be witnessed, dated and signed off by both the Contractor (or designee) and the Engineer upon satisfactory completion.

1.07 CONTROL SYSTEM STARTUP AND TESTING

A. Control system startup and testing shall be performed to demonstrate complete compliance with all specified functional and operational requirements. Testing activities shall include the simulation of both normal and abnormal operating conditions.

B. All digital hardware shall be fully inspected and tested for function, operation and continuity of circuits. All diagnostic programs shall be run to verify the proper operation of all digital equipment.

C. Final control elements and ancillary equipment shall be tested under start-up and steady-state operating conditions to verify that proper and stable control is achieved using local area control panels, motor control center circuits, and local field mounted control circuits. All hardwired control circuit interlocks and alarms shall be operational. The control to final control elements and ancillary equipment shall be tested using both manual and automatic (where provided) control circuits.

D. Signals from transducers, sensors, and transmitters shall be utilized to verify control responses for final control elements. Simulated input data signals may be used subject to prior written approval by the Engineer.

E. Each control strategy shall be tested to verify the proper operation of all required functions. The control system start-up and test activities shall include procedures for tuning all control loops incorporating PID control modules, and for adjusting and testing all control loops as required to verify specified performance.

F. The control system start-up and test activities shall include running tests to prove that the Instrumentation, Control and Information System is capable of continuously, safely and reliably regulating processes, as required by the Contract, under service conditions that simulate, to the greatest extent possible, normal plant operating ranges and environmental conditions.

G. A witnessed functional acceptance test shall be performed to demonstrate satisfactory performance of individual monitoring and control loops and control strategies. At least one test shall be performed to verify that the control and instrumentation system is capable of simultaneously implementing all specified operations.

H. Each loop and control strategy test shall be witnessed and signed off by both the Contractor (or designee) and the Engineer upon satisfactory completion.

1.08 FACILITY STARTUP COORDINATION

A. Facility start-up shall comply with requirements specified in the Contract Documents and those requirements specified herein. Facility start-up shall commence after all previously described start-up and test activities have been successfully completed and shall demonstrate that the Instrumentation, Control and Information System can meet all Contract requirements with equipment operating over full operating ranges under actual operating conditions.

B. The control system start-up period shall be coordinated with process startup activities and shall be extended as required until all plant processes are fully operational and to satisfy the Engineer that all control system Contract requirements have been fulfilled in accordance with the Contract Documents.

C. The instrumentation subcontractor's personnel shall be resident at the facility to provide both full time (eight hours/day, five days/week) and 24 hours on call (seven days/week) support of operating and maintenance activities for the duration of the start-up period.

D. At least one qualified control systems technician shall be provided for control system startup and test activities and at least two when loop checkout is being performed.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 40 61 21.73
FINAL ACCEPTANCE TEST

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall perform the Final Acceptance Test on the Control and Information System as specified herein to demonstrate compliance with the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 40 61 13 – Process Control System General Provisions

B. Section 40 61 21 – Process Control System Testing

C. Section 40 61 21.72 – Field Testing

1.03 AVAILABILITY DEMONSTRATION AND FINAL SYSTEM ACCEPTANCE

A. Upon completion of all control system startup activities and prior to final system acceptance, the Contractor shall demonstrate that the availability of the entire control system, including operation under conditions of digital equipment fail-over, initiated either automatically or manually, shall be not less than 99.8 percent during a 30-day availability test period. The Owner shall be given two (2) weeks' notice of the starting date of the 30-day availability test.

B. For purposes of determining availability figures, downtime of each system or portions of each system resulting from the causes specified hereunder will not be considered system failures.

1. Downtime of any network-connected device that is automatically backed-up upon failure shall not be considered a system failure provided that the downtime of the failed component does not exceed 24 hours.

2. Downtime of a PLC that is not automatically backed-up shall be considered a system failure if the downtime of the failed controller exceeds one (1) hour.

3. Downtime of a portion of the system resulting from failure of any field sensor shall not be considered a system failure provided that the system operates as specified under this condition.

4. Downtime of the following devices shall not be considered a system failure provided the failed device is repaired within the specified time:

a. Hard disc (one day)

b. Workstations (one day)

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c. Communication interfaces (eight hours)

d. Printer (three days)

e. Process control system networks (eight hours)

f. Off-line (optical, etc.) storage units (one day)

g. UPS unit (one day)

5. Total shutdown of a single PLC resulting from a software fault shall be considered a system failure.

6. An erroneous command to the process that can be specifically related to a software fault shall be considered as one (1) hour of downtime.

7. The inoperability of any subsystem resulting from a software fault shall be considered a system failure.

8. The failure of the same component more than one time during the 30-day test shall be considered a system failure.

C. If the system fails the 30-day availability test, the 30-day test period shall be restarted after the failed component or software is repaired/replaced and full operation is restored. The system shall be demonstrated for the full 30-day period following the restart.

D. The Contractor shall submit an availability demonstration report that shall state that all system availability requirements have been met.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 40 61 22

TOOLS, SUPPLIES, AND SPARE PARTS, GENERAL

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall provide tools, supplies, and spare parts as specified herein for the operation and maintenance of the Control and Information System.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 40 61 13 – Process Control System General Provisions

PART 2 – PRODUCTS

2.01 TOOLS

A. Furnish special tools, other than those normally found in an electronic technician's tool box, required to test, diagnose, calibrate, install, wire, connect, disconnect, assemble and disassemble any digital equipment, instrument, panel, rack, cabinet or console mounted equipment for service and maintenance. This shall include, but not be limited to, the following: connector pin insertion and removal tools, wire crimping tools, special wrenches, special instrument calibrators, indicator lamp insertion and removal tools, etc.

B. Furnish tools and test equipment together with items such as instruction manuals, carrying/storage cases, unit battery charger where applicable, special tools, calibration fixtures, cord extenders, patch cords and test leads, which are not specified but are necessary for checking field operation of equipment supplied under this Division.

C. Furnish one portable graphical multimeter with rechargeable battery, test leads, industrial lead set, and carrying case, Fluke Model 289, Simpson, or approved equal.

D. Furnish one portable 4-20 mA, 24 VDC analog loop signal generator for calibration and testing of analog signal loops. Generator shall be furnished with rechargeable battery pack, test leads, spare battery pack, charger, carrying case and accessories. Signal generator shall be Fluke 787 ProcessMeter, or approved equal.

E. Furnish one portable calibrator capable of measuring DC volts, mV, mA, ohms, frequency, T/C, peak detect and trip detect on its input and simultaneously generate on its output all of the preceding signals plus two-wire simulation, ramp functions, up/down stepping and 10 point programmability. The calibrator shall be furnished complete with 24 VDC integral battery pack, spare battery pack, test leads, external charger, fuse pack, carrying case and appurtenances. It shall be possible to store and use automatic instrument calibration procedures that are downloaded from Windows-based instrument management software. Calibrator shall be Fluke 789 ProcessMeter, Ametek CL-9000, or approved equal.

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F. Furnish one complete computer technician kit in an organized soft-sided case. The kit shall be Model JTK-49CBR Workstation Kit by Jensen Tools & Supply or an approved equal computer technician kit of equivalent equipment and value.

2.02 SUPPLIES

A. The Contractor shall provide supplies as specifically required in other Sections of Division 40.

2.03 SPARE PARTS

A. Furnish spare parts for items of control and instrumentation equipment as recommended by the manufacturer and in accordance with the Contract Documents.

B. Furnish all spares in moisture-proof boxes designed to provide ample protection for their contents. Label all boxes to clearly identify contents and purpose.

C. The Contractor shall replace all spare parts consumed during installation, testing, start-up, the system availability demonstration, and the guarantee period.

D. Refer to individual digital hardware and instrument sections for additional requirements specific to those devices.

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 40 61 23
SIGNAL COORDINATION REQUIREMENTS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall conform to the signal coordination requirements specified herein.

B. The Contractor shall be responsible for coordinating signal types and transmission requirements between the various parties providing equipment under this Contract. This shall include, but not be limited to, distribution of appropriate shop drawings among the equipment suppliers, the electrical subcontractor, the HVAC subcontractor, and the instrumentation subcontractor.

C. Analog signals shall be signals for transmitting process variables, etc. from instruments and to and from panels, equipment PLCs and Control System PLCs.

D. Discrete signals shall consist of contact closures or powered signals for transmitting status/alarm information and control commands between starters, panels, equipment PLCs, the Control System, etc.

1.02 ANALOG SIGNAL TRANSMISSION

A. Signal transmission between electric or electronic instruments, controllers, and all equipment and control devices shall be individually isolated, linear 4-20 milliamperes and shall operate at 24 VDC.

B. Signal output from all transmitters and controllers shall be current regulated and shall not be affected by changes in load resistance within the unit's rating.

C. All cable shields shall be grounded at one end only, at the control panel, with terminals bonded to the panel ground bus.

D. Analog signal isolation and/or conversion shall be provided where necessary to interface with instrumentation, equipment controls, panels, and appurtenances.

E. Non-standard transmission systems such as pulse duration, pulse rate, and voltage regulated shall not be permitted except where specifically noted in the Contract Documents. Where transmitters with nonstandard outputs do occur, their outputs hall be converted to an isolated, linear, 4-20 milliampere signal.

F. The Contractor shall provide 24 V power supplies for analog signals and instruments where applicable and as required inside panels, controls, etc.

G. Where two-wire instruments transmit directly to the Control and Information System, the instrumentation subcontractor shall provide power supplies at the PLC-equipped control panels for those instruments.

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H. Where four-wire instruments with on-board loop power supplies transmit directly to the Control and Information System, the instrumentation subcontractor shall provide necessary signal isolators or shall otherwise isolate the input from the Control and Information System loop power supply. Similar provisions shall be made when a third element such as a recorder, indicator, or single loop controller with integral loop power supply is included in the loop.

1.03 DISCRETE INPUTS

A. All discrete inputs to equipment and Control and Information System PLCs, from field devices, starters, panels, etc., shall be unpowered (dry) contacts in the field device or equipment, powered from the PLCs, unless specified otherwise.

B. Sensing power (wetting voltage) supplied by the PLC shall be 24 VDC.

1.04 DISCRETE OUTPUTS

A. All discrete outputs from local control panels and Control and Information System PLCs to field devices, starters, panels, etc., shall be 24 VDC powered (sourced) from PLC's [dry contact relay outputs].

B. PLC powered discrete outputs shall energize 24 VDC pilot relay coils in the field devices, starters, panels, etc. which in turn open or close contacts in the associated control circuit. The 24 VDC relay coil, contacts, and associated control circuitry shall be furnished integral with the field device, starter, panel, etc. by the supplier and contractor furnishing the field device, starter, or panel.

C. Where required or specified herein, discrete outputs from equipment and Control and Information System PLC's to field devices, starters, panels, motor operated valves, etc., shall be dry contact or relay outputs.

D. Outputs to solenoid valves shall be 120 VAC, powered from the PLC or control panel unless specified or shown otherwise.

1.05 OTHER DISCRETE SIGNALS

A. Discrete signals between starters, panels, etc. where no 24 VDC power supply is available may be 120 VAC, as long as such contacts are clearly identified in the starter, panel, etc. as being powered from a different power supply than other starter/panel components.

B. Where applicable, warning signs shall be affixed inside the starter, panel, etc. stating that the panel is energized from multiple sources.

C. Output contacts in the starter, panel, etc., that are powered from other locations shall be provided with special tags and/or color-coding. Disconnecting terminal strips shall be provided for such contacts.

D. The above requirements shall apply to all starters and panels, regardless of supplier.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 40 61 24
QUALITY ASSURANCE

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. It is the intent of these Specifications and Drawings to secure high quality in materials, equipment and workmanship in order to facilitate operations and maintenance of the facility. The Contractor shall provide equipment and services to meet this intent.

1.02 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. All Work shall be installed in accordance with the National Electric Code, National Electric Safety Code, OSHA, State, local and other applicable codes.

1.03 QUALITY ASSURANCE - GENERAL

A. All equipment and materials shall be new and the products of reputable recognized suppliers having adequate experience in the manufacture of these particular items.

B. For uniformity, only one manufacturer and model will be accepted for each type of product. Where differing models are required, equipment from a single manufacturer shall be provided.

C. Equipment shall be designed for the service intended and shall be of rugged construction, of ample strength for stresses that may occur during fabrication, transportation, and erection as well as during continuous or intermittent operation. They shall be adequately stayed, braced and anchored and shall be installed in a neat and workmanlike manner. Appearance and safety, as well as utility, shall be given consideration in the design of details.

D. All components and devices installed shall be standard items of industrial grade, unless otherwise noted, which shall be of sturdy and durable construction and be suitable for long, trouble-free service.

E. Electronic components shall be de-rated to assure dependability and long-term stability.

F. Printed circuit boards in field mounted equipment shall be suitable for the specified environmental conditions.

G. Alignment and adjustments shall be non-critical, stable with temperature changes or aging and accomplished with premium grade potentiometers.

H. Components of specially selected values shall not be inserted into standard electronic assemblies in order to meet the performance requirements of this specification.

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1.04 OPTIONAL EQUIPMENT

A. Optional or substituted equipment or both requiring changes in details or dimensions required to maintain structural, mechanical, electrical, control, operating, maintenance or design features incorporated in these Specifications and Drawings shall be made at no additional cost to the Owner. In the event that the changes are necessary, calculations and drawings showing the proposed revisions shall be submitted for approval. The Contractor shall coordinate changes with other affected trades and contracts and pay additional charges incurred.

1.05 GUARANTEE

A. The instrumentation subcontractor through the Contractor shall install, maintain and guarantee the Instrumentation, Control and Information System as specified under the General Conditions and Division 01 of the Specifications. Maintenance personnel provided by the instrumentation subcontractor shall instruct the Owner's personnel in the operation, adjustment, calibration and repair of the equipment being serviced. Preventive and corrective activities shall be documented with service reports, which shall identify the equipment being serviced, state the condition of the equipment, describe Work performed and list materials used. A copy of service reports shall be delivered to the Owner on the day the Work is performed.

B. The instrumentation subcontractor shall provide the services of factory-trained service technician(s) at least twice during the guarantee period, for the purpose of performing preventive hardware maintenance.

C. Corrective hardware and software maintenance during the guarantee period shall be performed in accordance with the requirements of Division 01 and, in addition, shall meet the following requirements:

1. Corrective hardware maintenance shall be performed by factory-trained service technician(s) specifically trained to service the digital equipment provided. Technicians possessing suitable training and experience shall be provided to perform corrective maintenance on other equipment. The hardware service technician(s) shall be available on-site within 24 working hours after notification by the Owner.

2. Corrective software maintenance shall be performed for software provided by the instrumentation subcontractor and incorporated into the system prior to the completion of system commissioning. Software service programmer(s) shall be available for consultation within four business hours and, if required, on-site within 16 business hours after notification by the Owner. Corrective software maintenance shall include the supply, installation and startup of application software upgrades released during the guarantee period.

3. Corrective hardware and software maintenance performed during the guarantee period shall be performed at no cost to the Owner.

4. As used herein, the term "working hours" shall be defined as those of the treatment facility (seven days per week, 24 hours per day). The term "business hours" shall be defined as the hours between 8:00 a.m. and 5:00 p.m., local time, Monday through Friday; excluding holidays.

5. The guarantee period shall commence upon final acceptance of the completed treatment facility in accordance with the provisions of the Contract Documents.

D. The instrumentation subcontractor shall submit to the Owner a proposed maintenance agreement incorporating the following features:

1. Extension of preventive hardware maintenance services as described above for a period of up to five years from the expiration of the warranty period.

2. Provisions for corrective hardware or software maintenance Work on a will-call basis for a period of up to five years from the expiration of the warranty period. Corrective maintenance Work shall be performed by properly trained personnel as described above.

E. The proposed agreement shall include provisions for payment based upon an annual fee for preventive maintenance and cost plus expenses for corrective maintenance Work. The portion dealing with corrective maintenance shall be written to include corrective maintenance caused by actions of the Owner during the warranty period and shall contain clauses for re-negotiation of contract prices based upon changes in recognized economic indicators published by the United States Department of Commerce.

1.06 SHIPPING HANDLING AND STORAGE

A. In addition to shipping, handling and storage requirements specified elsewhere in the Contract Documents, air conditioning/heating shall be provided for storage of field instrumentation, panels, digital equipment and ancillary devices to maintain temperatures between 20 and 25 degrees C and relative humidity 40 to 60 percent without condensation. The air shall be filtered and free of corrosive contaminants and moisture.

1.07 FABRICATION

A. Fabrication of equipment shall conform to the codes and standards outlined in this Section, and other portions of the Contract Documents.

B. The Engineer may inspect the fabricated equipment at the factory before shipment to job site. The Contractor shall provide the Engineer with sufficient prior notice so that an inspection can be arranged at the factory. Inspection of the equipment at the factory by

the Engineer will be made after the manufacturer has performed satisfactory checks, adjustments, tests and operations.

C. Equipment approval at the factory only allows the equipment to be shipped to the project site. The Contractor shall provide for the proper storage, installation and satisfactory start-up and operation of the equipment to the satisfaction of the equipment manufacturer, the instrumentation subcontractor, and the Engineer.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 INSTALLATION

A. Instrumentation and control system installation Work, whether new construction or modifications to existing equipment/panels/structures, shall conform to the codes and standards outlined in this Section, and other portions of the Contract Documents.

B. The instrumentation subcontractor shall assign a competent representative who shall provide full time coordination and supervision of on-site instrumentation and control system construction Work from commencement of construction through completion and final acceptance.

C. Labor shall be performed by qualified craftsmen in accordance with the standards of workmanship in their profession and shall have had a minimum of three years of documented experience on similar projects.

D. Equipment and materials shall fit properly in their installations. Work required to correct improperly fit installations shall be performed at no additional expense to the Owner.

E. Work shall be performed in a neat and workmanlike manner. Hardware and instrumentation shall be installed in accordance with requirements specified herein, in accordance with industry best practices, in accordance with manufacturers' recommendations, and in a manner suitable for ease of operation, inspection, and maintenance. Wiring shall be neatly bundled, run in wireway, and terminated. Spare wiring shall be neatly coiled and clearly labeled at both ends for future use by the Owner. Work not meeting these requirements shall be corrected at no expense to the Owner.

F. Sufficient common-mode and differential-mode noise rejection shall be provided to ensure proper operation of the plant process control system. General practices shall include:

1. Maintaining crossings between noisy wires and signal wires at right angles.

2. Maintaining separation between noisy wires and signal wires as wide as practical.

3. Grounding all signals, shields and power supplies at the process control unit or local control panel.

4. Providing passive filters on signals with time constant compatible with scan intervals and overvoltage protection.

5. Eliminating cable splices. Splices in instrumentation and control system signal, network, and instrument manufacturer furnished cables shall be approved in advance by the Engineer.

6. Providing a floating output for transmitters that have their own power sources.

G. DC and AC power grounding shall be performed in accordance with the digital hardware manufacturer's recommendations as well as all applicable code requirements.

H. The case of each field instrument and control panel shall be grounded in compliance with the National Electric Code.

I. Power wires shall be separated from parallel-running signal wires by the following minimum spacing:

1. 120 VAC: 12 in

2. 240 VAC: 18 in

3. 480 VAC: 18 in

4. 2000 VAC and above: 24 in

J. The Contractor shall provide all required cutting, drilling, inserts, supports, bolts, and anchors, and shall securely attach all equipment and materials to their supports. Embedded supports for equipment furnished under this Division shall be provided and installed as shown specified herein and shown on the Drawings.

K. Following acceptance of the factory tests by the Engineer, and in accordance with the construction schedule, the Contractor shall commence installation of the digital control system hardware. Digital system equipment items shall not be installed, however, until all architectural, mechanical, HVAC and electrical Work has been completed in the equipment rooms, MCCs, control rooms and all structural and mechanical Work has been completed within 50 feet of equipment locations.

L. Upon completion of the above construction Work, the Contractor shall request an inspection of the above-named areas. The Engineer will issue a written approval to proceed with delivery and installation only after being satisfied that all Work described above has been properly performed. Digital equipment shall remain at the factory site or storage prior to approval for delivery to the project site. Partial shipments may be required to meet construction schedule requirements.

END OF SECTION

SECTION 40 61 26
PROCESS CONTROL SYSTEM TRAINING

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. To familiarize the Owner's personnel with the process control system and field instrumentation, training shall be provided as detailed hereunder.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 40 61 13 – Process Control System General Provisions

1.03 SUBMITTALS

A. A minimum of 60 days prior to beginning training, submit a detailed training plan describing the following:

1. A listing of all courses to be conducted.

2. Course content.

3. Applicability of each course to management, operations, maintenance, laboratory, etc., personnel.

4. Course schedules.

5. Qualifications and experience of individual(s) providing training.

B. A minimum of 14 days prior to beginning each training course, submit documentation for use by the Owner's personnel during training. The training documentation shall be specific to the particular course, and shall include the following:

1. A listing of all subjects to be covered.

2. Course schedule.

3. Documentation/lesson plans covering all subjects to be covered during the course instruction. Information shall be in a "how to" format, with sufficient background documentation and references to manufacturer literature to provide a thorough and clear understanding of the materials to be covered.

1.04 GENERAL REQUIREMENTS

A. All costs of providing the training courses shall be borne by the Contractor.

B. As used herein, the term "day" shall mean an eight-hour day, and the term "week" shall mean a five-day, 40-hour week.

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C. Training courses, especially those for operator training, may be required to be scheduled during non-standard business hours (i.e., not between the hours of 8:00 am and 5:00 pm) to accommodate the working schedule of the Owner’s personnel. No additional compensation will be awarded to the Contractor for training at non-standard hours.

D. All training courses shall complement the experience and skill levels of the Owner's personnel.

E. Training courses shall be structured in order of increasing capability or security levels. The purpose of this requirement is to allow personnel with lesser training requirements or security password levels to drop out of the training at certain times while the training continues for personnel with greater requirements or higher security levels.

F. All training courses shall include lecture as well as "hands on" experience for each of the attending personnel. The Contractor shall provide sufficient equipment for this to be accomplished. For example, training in which the instructor uses the computer and the Owner's personnel passively observe as the instructor demonstrates system functions shall not be acceptable.

G. Unless otherwise specified, all training courses shall be conducted in the Owner's facilities.

H. All training shall be completed prior to system acceptance.

I. Standard manufacturer training courses are acceptable pending approval by the Engineer and Owner.

1.05 SYSTEM SUPERVISOR/ENGINEER TRAINING

A. Provide manufacturer standard training in the use and configuration of the specified operator workstation (HMI or SCADA) software.

B. System supervisor/engineer training shall be performed a minimum of 30 days prior to system startup.

C. Training shall be provided in the following subjects:

1. System overview and capabilities.

2. Database configuration.

3. Graphic display configuration, including linking of data to displays.

4. Historical data configuration (collection, manipulation, and display).

5. Real-time and historical trending.

6. Report configuration, generation, printing, and customization.

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7. Alarm configuration and management.

8. System security.

9. I/O driver use and configuration.

10. System backup and recovery.

11. DDE linking, where applicable.

12. System command language.

13. Troubleshooting.

14. System optimization.

15. System startup and shutdown procedures.

16. LAN and WAN communications, as appropriate.

D. The course shall be structured as follows:

1. Fundamentals – One four-day course (minimum) shall be provided for up to eight persons which shall serve as a digital control system familiarization course for project management personnel, engineers, and key operating/maintenance personnel. This course shall be a prerequisite for the advanced course described below in Item 2.

2. Advanced – One four-day (minimum) digital system configuration and operating course shall be provided for up to four persons. The level of training shall be sufficient to familiarize the Owner's personnel with the configuration and application of all system programs. All essential system operating procedures shall be described as required to enable the Owner's personnel to operate the system via the various workstations and local control panels.

3. Historical – One two-day course to instruct a minimum of four persons in the use and configuration of the historical data archival system. Training shall include creation, viewing, and printing of trends, charts, and reports. Training shall include all database maintenance and archival functions necessary to maintain the facility’s data on both short and long term basis, including periodic archival to optical media.

1.06 OPERATOR TRAINING

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A. Two two-week courses comprised of daily half-day (four-hour) sessions for up to ten persons each shall be conducted to provide instruction in the use of the Control and Information System to monitor and control the facility.

B. Operator training shall include familiarization training covering the Control and Information System. Operators shall be instructed in the names, locations, functions, and basic operation of all items of digital equipment and associated software.

C. Operator training shall cover process and equipment operation both individually and collectively as an operating system. Normal as well as abnormal operating conditions shall be covered, including the response to failure occurrences and system alarms. All operator/system interactions shall be described.

D. Operators shall be trained to instruct other operators and shall be provided with all course materials.

1.07 MAINTENANCE TRAINING

A. A three-day course shall be conducted for at least six persons prior to the start-up of digital equipment at the Owner's plant. Instruction shall be provided in the following:

1. Operating all digital equipment, including system start-up and shutdown procedures.

2. The use of hardware diagnostic routines, test equipment and test procedures as required to enable the Owner's personnel to detect and isolate system faults to the circuit board or module level and to implement repairs by replacing failed circuit boards or modules.

3. Calibration and routine maintenance procedures for all analog and digital equipment.

B. Step by step written procedures shall be provided for all preventive maintenance tasks and for identifying hardware faults to the circuit board or module level for all items of digital equipment.

C. All digital equipment preventive and corrective maintenance training activities shall be limited to the use of commercially available off-the-shelf test equipment and to the use of diagnostic routines and hardware items which are the same as those to be provided as part of the system.

1.08 INSTRUMENT TRAINING

A. A three-day course shall be provided at the Owner's facilities no more than three months prior to system start-up to instruct a minimum of five persons each in the calibration and preventive maintenance of the field instruments provided under this Contract.

1.09 PLC TRAINING

A. One minimum three-day manufacturer standard training course shall be provided in the programming and use of PLC's to implement monitoring and control functions such as

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those provided for this project. Training shall cover all aspects of the PLC hardware and software, including specified programming software. This training shall be provided by the PLC manufacturer or, as directed by the manufacturer, by the authorized distributor engaged by the manufacturer to perform this training.

B. One three-day course of specific training shall be provided by the instrumentation subcontractor in the use and modification of all control strategies provided under this Division.

1.10 GENERAL REFRESHER TRAINING

A. A one-week general refresher training course shall be provided for up to ten persons 3-6 months after final system acceptance. Instruction shall be given in all aspects of the complete instrumentation and control system. Instructor(s) shall be capable of answering questions related to all aspects and details of the complete system.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 40 61 91
PROCESS CONTROL SYSTEM INSTRUMENT LIST

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, test, install and place in satisfactory operation all instrumentation as herein specified and as shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 40 61 90 – Schedules and Control Descriptions, General

B. Section 40 61 93 – Process Control System Input/Output List

C. Section 40 61 96 – Process Control Descriptions

PART 2 – PRODUCTS

2.01 NAMEPLATES

A. Items of equipment listed in the instrument schedule, control panels, and digital hardware items shall be identified with nameplates. Each nameplate shall be located so that it is readable from the normal observation position and is clearly associated with the device or devices it identifies. Nameplates shall be positioned so that removal of the device for maintenance and repair shall not disturb the nameplate. Nameplates shall include, as necessary, the equipment identification number, description, calibrated range, and set point(s). Abbreviations of the description shall be subject to the Engineer's approval.

B. Nameplates shall be made of 1/16-inch thick machine engraved laminated phenolic plastic having white numbers and letters not less than 3/16-inch high on a black background. Nameplates attached to instruments may be black laser etched 1/8-inch high text on stainless steel with sharp edges made smooth. Stamped text shall not be acceptable.

C. Nameplates shall be attached to metal equipment by NEMA rated stainless steel screws and to other surfaces by an epoxy-based adhesive that is resistant to oil and moisture. In cases where the label cannot be attached by the above methods, it shall be drilled and attached to the associated device by means of a braided stainless steel wire affixed with a permanent crimp.

D. Submit sample nameplate of each type.

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PART 3 – INSTRUMENT SCHEDULE

SECTION 40 61 91

PROCESS CONTROL SYSTEM INSTRUMENT LIST

INSTRUMENT INDEX

PnPID	Dwg Number	Tag	Service Description	Power Req'd	Status	Function	Furnished By	Instrument Type	Panel/Inst.Detail	Range	Specification Section
920	I-02	LT-101	MS-100, UPSTREAM LEVEL		New	LEVEL	VENDOR-FLD MTD	RADAR LEVEL TRANSMITTER	I-40-0218	53.07 to 55.00 ft	40 75 29.13
922	I-02	LT-102	MS-100, DOWNSTREAM LEVEL		New	LEVEL	VENDOR-FLD MTD	RADAR LEVEL TRANSMITTER	I-40-0218	52.99 to 54.71 ft	40 75 29.13
2512	I-02	LSH-103	MS-100, UPSTREAM LEVEL		New	HIGH LEVEL	VENDOR-FLD MTD	FLOAT SWITCH	I-40-0206	ON/OFF ~ 60.5 ft	40 72 76.26
930	I-02	LT-201	MS-200, UPSTREAM LEVEL		New	LEVEL	VENDOR-FLD MTD	RADAR LEVEL TRANSMITTER	I-40-0218	53.07 to 55.00 ft	40 75 29.13
926	I-02	LT-202	MS-200, DOWNSTREAM LEVEL		New	LEVEL	VENDOR-FLD MTD	RADAR LEVEL TRANSMITTER	I-40-0218	52.99 to 54.71 ft	40 75 29.13
2518	I-02	LSH-203	MS-200, UPSTREAM LEVEL		New	HIGH LEVEL	VENDOR-FLD MTD	FLOAT SWITCH	I-40-0206	ON/OFF ~ 60.5 ft	40 72 76.26
939	I-02	LT-301	MS-300, UPSTREAM LEVEL		New	LEVEL	VENDOR-FLD MTD	RADAR LEVEL TRANSMITTER	I-40-0218	53.07 to 55.00 ft	40 75 29.13
935	I-02	LT-302	MS-300, DOWNSTREAM LEVEL		New	LEVEL	VENDOR-FLD MTD	RADAR LEVEL TRANSMITTER	I-40-0218	52.99 to 54.71 ft	40 75 29.13
2520	I-02	LSH-303	MS-300, UPSTREAM LEVEL		New	HIGH LEVEL	VENDOR-FLD MTD	FLOAT SWITCH	I-40-0206	ON/OFF ~ 60.5 ft	40 72 76.26
2334	I-02	PG-510	NPW, PRESSURE GUAGE		New	WASH WATER PRESSURE	SI	PRESSURE/DP GAUGE	I-40-0303	0-100 PSIG	40 73 13
3091	I-03	AISH-700	AISH-700, GAS DETECTION PANEL	120VAC	New	GAS DETECTION	SI	GAS DETECTION/ALARM PANEL			40 76 20
3335	I-03	AE-701	AIT-701, SCREEN AREA COMBUSTIBLES		New	COMBUSTIBLE (METHANE) DETECTOR	SI	GAS SENSOR	I-40-0506	0 - 100% LEL	40 76 20
1168	I-03	AIT-701	AIT-701, SCREEN AREA COMBUSTIBLES		New	COMBUSTIBLE (METHANE) DETECTOR	SI	GAS TRANSMITTER	I-40-0506	0 - 100% LEL	40 76 20
3333	I-03	AE-702	AIT-702, SCREEN AREA OXYGEN		New	O2 DETECTOR	SI	GAS SENSOR	I-40-0506	0 - 25% O2	40 76 20
1166	I-03	AIT-702	AIT-702, SCREEN AREA OXYGEN		New	O2 DETECTOR	SI	GAS TRANSMITTER	I-40-0506	0 - 25% O2	40 76 20
3331	I-03	AE-703	AIT-703, SCREEN AREA H2S		New	H2S DETECTOR	SI	GAS SENSOR	I-40-0506	0 - 50 ppm H2S	40 76 20
1164	I-03	AIT-703	AIT-703, SCREEN AREA H2S		New	H2S DETECTOR	SI	GAS TRANSMITTER	I-40-0506	0 - 50 ppm H2S	40 76 20
1238	I-03	FSL-705	SF-1, SUPPLY FAN FLOW	120VAC	New	LOW FLOW SWITCH	SI	THERMAL FLOW SWITCH	I-40-0107		40 71 79.16
1257	I-03	FSL-706	EF-1, EXHAUST FAN FLOW	120VAC	New	LOW FLOW SWITCH	SI	THERMAL FLOW SWITCH	I-40-0107		40 71 79.16
5802	I-03	DPSL-707	DPSL-707, SCREEN AREA EXHAUST FAN		New	FAN OPERATING ALARM	HVAC	DIFFERENTIAL PRESSURE SWITCH			N/A
3341	I-03	AE-711	AIT-711, COMPACTOR AREA COMBUSTIBLES		New	COMBUSTIBLE (METHANE) DETECTOR	SI	GAS SENSOR	I-40-0506	0 - 100% LEL	40 76 20
3060	I-03	AIT-711	AIT-711, COMPACTOR AREA COMBUSTIBLES		New	COMBUSTIBLE (METHANE) DETECTOR	SI	GAS TRANSMITTER	I-40-0506	0 - 100% LEL	40 76 20
3339	I-03	AE-712	AIT-712, COMPACTOR AREA OXYGEN		New	O2 DETECTOR	SI	GAS SENSOR	I-40-0506	0 - 25% O2	40 76 20
3058	I-03	AIT-712	AIT-712, COMPACTOR AREA OXYGEN		New	O2 DETECTOR	SI	GAS TRANSMITTER	I-40-0506	0 - 25% O2	40 76 20
3337	I-03	AE-713	AIT-713, COMPACTOR AREA H2S		New	H2S DETECTOR	SI	GAS SENSOR	I-40-0506	0 - 50 ppm H2S	40 76 20
3056	I-03	AIT-713	AIT-713, COMPACTOR AREA H2S		New	H2S DETECTOR	SI	GAS TRANSMITTER	I-40-0506	0 - 50 ppm H2S	40 76 20
3122	I-03	AL-721	LAS-721, SCREEN AREA ALARM PANEL		New	GAS IS DETECTED	ELECTRICAL	PILOT LIGHT-RED	E-10, HAZARDOUS		SEE DWG. E-10
3124	I-03	YL-721	LAS-721, SCREEN AREA ALARM PANEL		New	GAS NOT DETECTED	ELECTRICAL	PILOT LIGHT-GREEN	E-10, HAZARDOUS		SEE DWG. E-10
3062	I-03	AL-722	LAS-722, DUMPSTER AREA ALARM PANEL		New	GAS IS DETECTED	ELECTRICAL	PILOT LIGHT-RED	E-10, HAZARDOUS		SEE DWG. E-10
3064	I-03	YL-722	LAS-722, DUMPSTER AREA ALARM PANEL		New	GAS NOT DETECTED	ELECTRICAL	PILOT LIGHT-GREEN	E-10, HAZARDOUS		SEE DWG. E-10
3083	I-03	AL-723	LAS-724, COMPACTOR AREA ALARM PANEL		New	GAS IS DETECTED	ELECTRICAL	PILOT LIGHT-RED	E-10, HAZARDOUS		SEE DWG. E-10
3085	I-03	YL-723	LAS-724, COMPACTOR AREA ALARM PANEL		New	GAS NOT DETECTED	ELECTRICAL	PILOT LIGHT-GREEN	E-10, HAZARDOUS		SEE DWG. E-10
3087	I-03	AL-724	LAS-724, Field Indicator Light		New	GAS IS DETECTED	ELECTRICAL	PILOT LIGHT-RED	E-10, STACKABLE		SEE DWG. E-10
3089	I-03	YL-724	LAS-724, Field Indicator Light		New	GAS NOT DETECTED	ELECTRICAL	PILOT LIGHT-GREEN	E-10, STACKABLE		SEE DWG. E-10
3079	I-03	AL-725	LAS-725, SOUTH SIDE ALARM PANEL		New	GAS IS DETECTED	ELECTRICAL	PILOT LIGHT-RED	E-10, STACKABLE		SEE DWG. E-10
3081	I-03	YL-725	LAS-725, SOUTH SIDE ALARM PANEL		New	GAS NOT DETECTED	ELECTRICAL	PILOT LIGHT-GREEN	E-10, STACKABLE		SEE DWG. E-10
3075	I-03	AL-726	LAS-726, SOUTH WEST DOOR ALARM PANEL		New	GAS IS DETECTED	ELECTRICAL	PILOT LIGHT-RED	E-10, STACKABLE		SEE DWG. E-10
3077	I-03	YL-726	LAS-726, SOUTH WEST DOOR ALARM PANEL		New	GAS NOT DETECTED	ELECTRICAL	PILOT LIGHT-GREEN	E-10, STACKABLE		SEE DWG. E-10
3211	I-03	AL-727	LAS-727, WEST ENTRY DOOR ALARM PANEL		New	GAS IS DETECTED	ELECTRICAL	PILOT LIGHT-RED	E-10, STACKABLE		SEE DWG. E-10
3213	I-03	YL-727	LAS-727, WEST ENTRY DOOR ALARM PANEL		New	GAS NOT DETECTED	ELECTRICAL	PILOT LIGHT-GREEN	E-10, STACKABLE		SEE DWG. E-10

END OF SECTION

SECTION 40 61 93
PROCESS CONTROL SYSTEM INPUT / OUTPUT LIST

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, test, install and place in satisfactory operation all control system inputs and outputs as herein specified and as shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 40 61 90 – Schedules and Control Descriptions, General

B. Section 40 61 91 – Process Control System Instrument List

C. Section 40 61 96 – Process Control Descriptions

PART 2 – PRODUCTS

A. Refer to Input / Output Schedule included at the end of this Section.

PART 3 – CONTROL SYSTEM INPUT / OUTPUT SCHEDULE

A. Refer to Input / Output Schedule included after the “End of Section” designation.

1. Notes: Input/Output types are as follows:

    a. DI – Discrete Input

    b. DO – Discrete Output

    c. AI – Analog Input

    d. AO – Analog Output

    e. DAI – Digital Analog Input – Modbus

    f. DDI – Digital Discrete Input - Modbus

END OF SECTION

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SECTION 40 61 93

PROCESS CONTROL SYSTEM INPUT / OUTPUT LIST

Key	PLC/RIO	Signal Type	Rack	Slot	Point	I/O TAG	Drawing Reference	Associated Field Device	Service Description	I/O List Comment
4133	RTU01	DAI				SI-100	I-02	MS-100	MS-100, SPEED FEEDBACK	
4118	RTU01	DAI				LI-101	I-02	MS-100	MS-100, UPSTREAM LEVEL	
4115	RTU01	DAI				LI-102	I-02	MS-100	MS-100, DOWNSTREAM LEVEL	
4127	RTU01	DAI				SI-200	I-02	MS-200	MS-200, SPEED FEEDBACK	
4121	RTU01	DAI				LI-201	I-02	MS-200	MS-200, UPSTREAM LEVEL	
4601	RTU01	DAI				LI-202	I-02	MS-200	MS-200, DOWNSTREAM LEVEL	
4161	RTU01	DAI				SI-300	I-02	MS-300	MS-300, SPEED FEEDBACK	
4147	RTU01	DAI				LI-301	I-02	MS-300	MS-300, UPSTREAM LEVEL	
4164	RTU01	DAI				LI-302	I-02	MS-300	MS-300, DOWNSTREAM LEVEL	
4109	RTU01	DDI				YA-100	I-02	MS-100	MS-100, FAULT	
4101	RTU01	DDI				YAK-100	I-02	MS-100	MS-100, E-STOP	
4107	RTU01	DDI				YLR-100	I-02	MS-100	MS-100, RUNNING	
4104	RTU01	DDI				YN-100	I-02	MS-100	MS-100, AUTO MODE	
4144	RTU01	DDI				YA-200	I-02	MS-200	MS-200, FAULT	
4136	RTU01	DDI				YAK-200	I-02	MS-200	MS-200, E-STOP	
4142	RTU01	DDI				YLR-200	I-02	MS-200	MS-200, RUNNING	
4139	RTU01	DDI				YN-200	I-02	MS-200	MS-200, AUTO MODE	
4158	RTU01	DDI				YA-300	I-02	MS-300	MS-300, FAULT	
4150	RTU01	DDI				YAK-300	I-02	MS-300	MS-300, E-STOP	
4156	RTU01	DDI				YLR-300	I-02	MS-300	MS-300, RUNNING	
4153	RTU01	DDI				YN-300	I-02	MS-300	MS-300, AUTO MODE	
4173	RTU01	DDI				YA-400	I-02	CONV-400	CONV-400, GATE A OPEN	
4175	RTU01	DDI				YA-400	I-02	CONV-400	CONV-400, GATE A CLOSED	
4430	RTU01	DDI				YA-400	I-02	CONV-400	CONV-400, FAULT	
4167	RTU01	DDI				YAK-400	I-02	CONV-400	CONV-400, E-STOP	
4428	RTU01	DDI				YLR-400	I-02	CONV-400	CONV-400, RUNNING	
4170	RTU01	DDI				YN-400	I-02	CONV-400	CONV-400, AUTO MODE	
2228	RTU01	DI				YA-500	I-02	COMP-500	COMP-500, FAULT	
4404	RTU01	DI				YLRF-500	I-02	COMP-500	COMP-500, RUN FORWARD	
4407	RTU01	DI				YLRR-500	I-02	COMP-500	COMP-500, RUN REVERSE	
2304	RTU01	DI				YA-600	I-02	COMP-600	COMP-600, FAULT	
2312	RTU01	DI				YLRF-600	I-02	COMP-600	COMP-600, RUN FORWARD	
2297	RTU01	DI				YLRR-600	I-02	COMP-600	COMP-600, RUN REVERSE	
3322	RTU01	DI				AI-700	I-03	AISH-700	AISH-700, TROUBLE	
1213	RTU01	DI				ASH-700	I-03	AISH-700	AISH-700, GAS DETECTION ALARM	
3506	RTU01	DI				AX-700	I-03	AISH-700	AISH-700, ALARM RELAY PANEL	
4410	RTU01	DI				AI-701	I-03	AIT-701	AIT-701, COMB	
4413	RTU01	DI				AI-702	I-03	AIT-702	AIT-702, OXYGEN	
4416	RTU01	DI				AI-703	I-03	AIT-703	AIT-703, H2S	
1243	RTU01	DI				FAL-705	I-03	SF-1	SF-1, SUPPLY AIR FLOW LOW ALARM	
1265	RTU01	DI				FAL-706	I-03	EF-1	EF-1, EXHAUST AIR FLOW LOW ALARM	
3194	RTU01	DI				XA-706	I-03	SF-1	SF-1, FAN FAILURE	
3199	RTU01	DI				XA-706	I-03	EF-1	EF-1, FAN FAILURE	
5814	RTU01	DI				YA-709	I-03	UNIT HEATERS STATUS	UNIT HEATERS STATUS, BAR SCREEN UNIT HEATERS TRIPPED	
4419	RTU01	DI				AI-711	I-03	AIT-711	AIT-711, COMB	
4422	RTU01	DI				AI-712	I-03	AIT-712	AIT-712, OXYGEN	
4425	RTU01	DI				AI-713	I-03	AIT-7013	AIT-7013, H2S	
5826	RTU01	DO				YX-708	I-03	PLANT GENERATOR RUNNING	PLANT GENERATOR RUNNING, PLANT GENERATOR RUNNING	

SECTION 40 61 96
PROCESS CONTROL DESCRIPTIONS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, test, install and place in satisfactory operation all equipment as herein specified and as shown on the Drawings. THE CONTRACTOR SHALL BE RESPONSIBLE FOR FURNISHING COMPLETE FUNCTIONING SYSTEMS AS DESCRIBED HEREIN.

B. Together with the control system input/output schedule, the equipment specifications (including functional descriptions for local equipment control panels), and the Drawings, the functional control descriptions describe the required operation, monitoring, and control of the facilities included in this Contract.

C. THE FUNCTIONAL DESCRIPTIONS CONTAIN REQUIREMENTS FOR FURNISHING AND INSTALLING LABOR AND MATERIALS THAT MAY NOT APPEAR ELSEWHERE IN THE CONTRACT DOCUMENTS.

D. All equipment and services required in equipment local control panels provided to implement the monitoring and control functions described herein or in the process input/output schedules shall be provided by the Contractor through individual equipment suppliers.

E. Unless specifically stated otherwise, all interconnected wiring between all instruments, panels, controls, and other devices listed in the functional descriptions as required to provide all functions specified herein shall be furnished by the electrical subcontractor under Division 26. The electrical subcontractor shall provide all cable and conduit required to carry all signals listed in the process input/output schedules. Special cables that are required for interconnection between sensors or probes and transmitters or signal conditioners shall be furnished with the instrumentation devices by the equipment supplier.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 14 00 – Coordination with Owner’s Operations

B. Section 40 61 91 – Process Control System Instrument List

C. Section 40 61 93 – Process Control System Input/Output List

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PART 2 – FUNCTIONAL CONTROL DESCRIPTIONS, GENERAL

2.01 DEFINITIONS

A. RUNNING status signals shall be from auxiliary contacts provided with the motor control equipment (i.e., starter, VFD, SCR, etc.).

B. AUTO status signals shall be defined as HAND-OFF-AUTO switch in the AUTO position or process control system in AUTO (versus MANUAL).

C. FAIL status signals shall be defined as motor overload and/or any other shut down mode such as overtorque, overtemperature, low oil pressure, high vibration, etc.

D. READY status signal shall be defined as all conditions, including equipment control power, satisfied to permit remote control of the equipment.

2.02 CONVENTIONS

A. Operator workstation graphic display symbols and indicator lights on all MCC's, control panels, starter enclosures, etc. shall conform to the following color convention:

1. Running/On/Open: Red

2. Auto/Ready: White

3. Stopped/Off/Closed: Green

4. Fail/Alarm: Amber

5. Generic Status: White

2.03 PROCESS CONTROL

A. Where setpoints, operating limits, and other control settings are provided by the functional descriptions, these settings shall be initial settings only and shall be used for assistance in the initial startup of the plant. All such settings shall be fully adjustable and, based on actual operating conditions, the instrumentation subcontractor shall make all necessary adjustments to provide smooth, stable operation at no additional cost to the Owner.

B. Provision shall be made in PLC logic to suppress nuisance alarms and control actions by the following means:

1. For alarms and control actions derived from analog input signals, use adjustable time delays and deadbands.

2. For alarms and control actions derived from discrete input signals, use adjustable time delays.

3. Initial settings for time delays shall be 10 seconds (range 0-120 seconds). Initial settings for deadbands shall be 5% of span (range 0-100%).

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4. Equipment that is started or stopped manually by the operator shall start or stop immediately, with no time delay.

C. All setpoint control shall be by PID control algorithms. Where only proportional control is specified, tuning constants shall be used to reduce the Integral and Derivative functions to zero. All setpoints, sequence times, sequence orders, dead bands, PID tuning parameters, PLC delay timers, variable speed operating range limits, and similar control constants shall be accessible and alterable from the operator workstations.

D. Unless otherwise specified, all equipment shall automatically restart after a power failure utilizing adjustable start delay timers in PLC control logic. Unless otherwise specified, all PLC control strategies shall be based upon automatic restart after a power failure and shall return to a normal control mode upon restoration of power.

E. The PLC shall be capable of receiving initial run-time values for existing and proposed equipment. Initial run-time shall not automatically be assumed to be zero.

F. A control discrepancy alarm shall be generated through the PLC for any drive, motor, etc. for which a command has been issued, but for which the PLC is not receiving a confirming status signal (e.g., start command with no run feedback). The failure shall be logged.

G. An instrument failure alarm shall be generated for any instrument which is generating a signal that is less than 4 mA or greater than 20 mA.

H. Unless otherwise specified in an individual control description, an instrument failure or control discrepancy alarm shall cause the control strategy to maintain last values and to generate an alarm. Manual initiation of the automatic control strategy shall be required.

I. A control program that controls multiple pieces of equipment shall not be prevented from running because not all of the equipment is in AUTO. If equipment within an equipment chain is required to be running for program operation and it is running in HAND or MANUAL, then the program shall run and control the other equipment that is in AUTO.

J. All PLC wait states (internal time delays, etc.) after an operator action shall be displayed on the operator workstation.

PART 3 – FUNCTIONAL CONTROL DESCRIPTIONS

3.01 MECHANICAL SCREENS

A. Process Overview

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1. Except as explicitly noted in this section, the implementation of functions under this section shall be the responsibility of the mechanical screen equipment vendor as

described in specification Section 46 21 12 – Mechanically Cleaned Multi-Rake Type Bar Screen and shall be included as a requirement of the contract.

2. There will be three (3) mechanical screens in Screen Room, one (1) per screening channel. Screens shall be designed to capture and remove solid material from the screen channels and to discharge the removed material to the screening screw conveyor. During normal operation (both dry weather and wet weather), all three screens will be in service. Mechanical screen automatic cleaning cycle will be initiated on head differential across the screen and/or on timer. The speed of rakes movement would be controlled by head differential across the screen. Mechanical screens shall have jam detection and clear jam features.

3. Mechanical Screen manufacturer shall furnish one Local Control Panel (LCP) located in the Electrical Room and one Local Control Station (LCS) located in the Screen Room for each Mechanictal Screen.

4. Each mechanical screen shall be supplied with a dedicated Programmable Logic Controller (PLC) for machine control and an Operator Interface Terminal (OIT) for display and access. The PLC, OIT and any ancillary devices provided with the mechanical screen shall be fully programmed by the mechanical screen vendor to provide all control, monitoring and sequencing functions necessary for the proper operation of the mechanical screen. Refer to specification section 46 21 23 “Mechanically Cleaned Multi-Rake Type Bar Screens for detailed requirements and operation.

B. Control Operation

1. The control system for mechanical screens shall use PLC based control system.

2. Mechanical screen control system consists of a Local Control Panel LCP-x00 (x = 1,2,3) per screen located in the Electrical Room and a Local Control Station LCS-x00 (x=1,2,3) located next to the equipment in the screen room.

3. LCP-x00 (x = 1,2,3) shall be provided with a PLC (PLC-x00, an OIT (OIT-x00), a VFD (VFD-x00) where x-1,2,3, and all other items required start and stop the screen, change rake speeds by controlling VFD, and reverse on jamming and maintain and operate the equipment.

4. Each mechanical screen MS-x00 (x=1,2,3), shall be provided with a push button E-Stop switch, an upstream and a downstream level sensor, LT-x01 and LT-x02 (x = 1,2,3) respectively, which are used to calculate the differential level across the screen.

5. LCP-x00 (x = 1,2,3) shall be provided with a push button E-Stop switch, Running and Fault condition indicator lights, and an Operator Interface Terminal (OIT) mounted on the face of the panel.

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6. LCP-x00 (x = 1,2,3) PLC shall control mechanical screen MS-x00 (x=1,2,3) in Manual or Auto mode as described below.

7. During AUTO or MANUAL operation of the mechanical screen, the screen shall signal the screw conveyor to operate. If the screw conveyor does not confirm normal operation, the each of the mechanical screens shall stop to prevent jamming the system with material.

8. Manual Control

    a. Mechanical screen MS-x00 (x=1,2,3), shall be manually operated from LCP-x00 (x = 1,2,3) OIT by depressing/selecting MANUAL mode soft switch or operation of the LCS=x00, (x=1,2,3) local switches as described below.

    b. When the local HOA selector switch on LCS-x00, (x=1,2,3) is in the “AUTO” position, manual control shall be from the OIT:

        1) When the FORWARD soft switch is depressed, mechanical screen MS-x00 (x=1,2,3), shall operate forward at the speed entered by the operator on LCP-x00 (x = 1,2,3) OIT.

        2) When the OFF soft switch is depressed, mechanical screen MS-x00 (x=1,2,3), shall not operate.

        3) When the REVERSE soft switch is depressed, mechanical screen MS-x00 (x=1,2,3), shall operate in reverse at the speed entered by the operator on LCP-x00 (x = 1,2,3) OIT.

    c. When the local HOA selector switch on LCS-x00, (x=1,2,3) is in the “OFF” position, the mechanical screen shall not operate.

    d. When the local HOA selector switch on LCS-x00, (x=1,2,3) is in the “HAND” position, manual control shall be from the local FORWARD/REVERSE spring return selector switch mounted on the face fo LCS-x00 (x=1,2,3):

        1) In the default FORWARD position, the screen shall run in the forward direction at the speed set at the OIT.

        2) When held in the REVERSE position, the screen shall run in the reverse direction at the speed set at the OIT. When the spring return FORWARD/REVERSE selector switch is released, the screen will resume operations in the forward direction.

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9. Auto Control

    a. Mechanical screen MS-x00 (x=1,2,3), shall be placed into AUTO mode by depressing/selecting AUTO mode soft switch on LCP-x00 (x = 1,2,3) OIT as

described below. While in AUTO mode, the system may operate in either DIFFERENTIAL, TIMER or BOTH mode as selected by the operator. Upon initial power up or PLC reset, the BOTH mode shall be selected as the default mode for automatic operation.

b. In Automatic mode, mechanical screen MS-x00 (x=1,2,3), shall operate in the DIFFERENTIAL Mode when the Differential soft switch on LCP-x00 (x = 1,2,3) OIT is depressed. In Differential Mode:

1) mechanical screen MS-x00 (x=1,2,3) shall run at its low speed when the differential level high setpoint (operator adjustable from OIT) is detected.

2) Mechanical screen MS-x00 (x=1,2,3) shall run at its high speed when the differential level high-high setpoint (operator adjustable from OIT) is detected.

c. In Automatic mode, the Mechanical screen MS-x00 (x=1,2,3) shall operate in the TIMER Mode when the Timer soft switch on LCP-x00 (x = 1,2,3) OIT is depressed. In Timer Mode:

1) Mechanical screen MS-x00 (x=1,2,3) shall run at its low speed for the duration dictated by the exercise cycle low speed duration setpoint (operator adjustable from OIT) and at the frequency dictated by the exercise cycle frequency setpoint (operator adjustable from OIT).

d. In Automatic mode, the Mechanical screen MS-x00 (x=1,2,3) shall automatically operate in the BOTH Mode when the Both soft switch on LCP-x00 (x = 1,2,3) OIT is depressed. In Both Mode:

1) Mechanical screen MS-x00 (x=1,2,3) shall operate using the setpoints dictated for the Timer Mode. However, when the differential level high or high-high setpoints are detected, mechanical screen MS-x00 (x=1,2,3) shall operate in accordance with the Differential Mode.

10. When running in AUTO or MANUAL, electromechanical relay interlock controls in mechanical screen VFD-x00 (x=1,2,3) (provided within LCP-x00 (x = 1,2,3)) shall either not allow mechanical screen MS-x00 (x=1,2,3) to start or shut down if it is running, upon the following conditions:

a. E-Stop at LCS-x00 (x = 1,2,3) is depressed

b. Motor Overload

c. Motor Thermal Alarm

d. VFD Fault

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e. VFD Overcurrent - Jam Detected

f. Screw Conveyor stopped or did not confirm successful operation within five seconds of a mechanical screen start command.

When the electromechanical interlocks are engaged the system will illuminate the local FAULT condition light on LCP-x00, (x=1,2,3) and stop automatic operation by the PLC. When the interlock condition has cleared, the electromechanical interlocks may be reset by pressing the local “RESET” pushbutton on the face of LCP-x00, (x=1,2,3).

11. When running in AUTO or MANUAL-FORWARD mode, mechanical screen High Torque Alarm shall stop mechanical screen, run it in reverse for a predetermined duration (operator adjustable from OIT), and return it to forward operation regardless of the configuration of the control system. If the high torque alarm condition is cleared, mechanical screen shall return to normal operation. If high torque alarm persists, the reversing cycle shall be repeated up to a maximum of four times prior to initiating the VFD overcurrent - jam detected alarm contact.

12. The Mechanical Screen PLC (PLC-x00, x=1,2,3) shall provide outputs as shown on the P&IDs to allow monitoring of the mechanical screen operation by the plant SCADA system.

13. Final wiring and termination of output signals from the Mechanical Screen to the existing remote terminal unit shall be the responsibility of the contractor under specification Section 40 61 13 – Process Control System General Provisions.

14. Updates to existing plant SCADA system to incorporate the specified monitoring inputs shown on the P&IDs and provide operator interface displays shall be the responsibility of the contractor under specification Section 40 68 00.13 – Process Control Software (Modify).

3.02 SCREW CONVEYOR

A. Process Overview

1. Except as explicitly noted in this section, the implementation of functions under this section shall be the responsibility of the screw conveyor equipment vendor as described in specification Section 46 76 42 – Screw Conveyors and shall be included as a requirement of the contract.

2. There will be one screw conveyor in the Screen Room which will convey solid material removed by the mechanical screens to a washer/compactor located at its discharge.

3. Screw Conveyor manufacturer shall furnish one Local Control Panel (LCP-400) located in the Electrical Room.

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4. The Local Control Panel shall be provided with control pushbuttons and indicators located on the face of LCP-400. Controls shall include:

    a. HAND-OFF-AUTO selector switch

    b. FORWARD/REVERSE spring return selector switch

    c. E-Stop Pushbutton

    d. Running and Stopped indicator lights

    e. FAULT Condition indicator light

    f. RESET pushbutton

    g. Purge Timer with indication

    h. OPEN/CLOSED indicator lights for the discharge gate.

5. Screw conveyors shall be capable of remote or local operation.

B. Control Operations

1. The operator shall manually open or close the discharge gate by selecting the desired position using the HZS-400 hand switch on LCP-400 to control if the conveyor discharges into the washer/compactor or if it discharges into an end of the conveyor container.

2. MANUAL Operation

    a. The Conveyor CONV-400 shall be placed into MANUAL mode by selecting either the HAND or OFF position of the HAND/OFF/AUTO selector switch on LCP-400.

        1) While in OFF position, the conveyor shall not operate.

        2) While in the HAND position, the conveyor shall operate in either the FORWARD or REVERSE direction as determined by the operator's use of the spring return, two position FORWARD/REVERSE selector switch on LCP-400. The default position of the FORWARD/REVERSE selector switch shall be in the FORWARD position.

3. AUTO Operation

    a. The Conveyor CONV-400 shall be placed into AUTO mode by selecting AUTO position of the HAND/OFF/AUTO selector switch on LCP-400. While in AUTO mode, the system shall start operation when any of the three mechanical screens begin operating and shall continue operating for an

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adjustable time period, set by the purge timer, after the last mechanical screen has stopped.

4. When running in AUTO or MANUAL, electromechanical relay interlock controls in conveyor shall either not allow the conveyor to start or shut down if it is running, upon the following conditions:

   a. E-Stop pushbutton pressed on the local control panel LCP-400 or the emergency stop cord mounted adjacent to the conveyor.

   b. Zero Speed condition reported by YS-400 while the conveyor motor is running.

   c. Motor over-load or thermal shutdown condition.

   When an interlock condition exists, the conveyor shall illuminate the “FAULT” light on LCP-400 and signal a “FAULT” condition to the plant SCADA. After clearing a “FAULT” condition, the operator may reset for normal operation by pressing the “RESET” pushbutton on LCP-400.

5. The Conveyor control system (Conv-400) shall provide outputs as shown on the P&IDs to allow monitoring of the conveyor operation by the plant SCADA system.

6. Final wiring and termination of output signals from the Conveyor to the existing remote terminal unit shall be the responsibility of the contractor under specification Section 40 61 13 – Process Control System General Provisions.

7. Updates to existing plant SCADA system to incorporate the specified monitoring inputs shown on the P&IDs and provide operator interface displays shall be the responsibility of the contractor under specification Section 40 68 00.13 – Process Control Software (Modify).

3.03 SCREENINGS WASHER-COMPACTOR

A. Process Overview

1. Except as explicitly noted in this section, the implementation of functions under this section shall be the responsibility of the washer-compactor equipment vendor as described in specification Section 46 21 73 – Screenings Washer-Compactor and shall be included as a requirement of the contract.

2. There will be up to two washer/compactors, one initial, one future, in the Washer/Compactor Room which will receive solid material from the screw conveyor and wash / compact it for disposal.

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3. The Washer/Compactor manufacturer shall furnish one Local Control Panel (LCP-500) located in the Electrical Room and one Local Control Station (LCS-500) located adjacent to the equipment.

4. The Local Control Panel LCP-500 shall be provided with control pushbuttons and indicators located on the face of the panel. Controls shall include:

   a. Forward and Reverse Running indicator lights

   b. FAULT Condition indicator light

   c. RESET pushbutton

   d. Power available Indicator light

   e. Rinse Timer with indication

5. The Local Control Station (LCS-500) shall be provided with control pushbuttons, selector switches and indicators located on the face of the station. Control shall include:

   a. HAND-OFF-AUTO selector switch

   b. FORWARD/REVERSE spring return selector switch

   c. E-Stop Pushbutton

B. Control Operations

1. LOCAL Operation

   a. The Washer/Compactor COMP-500 shall be placed into LOCAL mode by selecting the LOCAL or OFF position of the LOCAL/OFF/AUTO selector switch on LCS-500.

      1) While in OFF position, the washer/compactor shall not operate.

      2) While in the LOCAL position, the washer/compactor shall operate in either the FORWARD or REVERSE direction as determined by the operator's use of the spring return, two position FORWARD/REVERSE selector switch on LCS-500. The default position of the FORWARD/REVERSE selector switch shall be in the FORWARD position.

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2. AUTO Operation

   a. The Washer/Compactor COMP-500 shall be placed into AUTO mode by selecting AUTO position of the LOCAL/OFF/AUTO selector switch on LCS-

500. While in AUTO mode, the system shall start operation when the conveyor CONV-400 begins operating and shall continue operating for an adjustable time period, set by the rinse timer, after the last conveyor has stopped.

3. When running in AUTO or MANUAL, electromechanical relay interlock controls in conveyor shall either not allow the conveyor to start or shut down if it is running, upon the following conditions:

   a. E-Stop pushbutton pressed on the local control panel LCS-500.

   b. Motor over-load or thermal shutdown condition.

   When an interlock condition exists, the washer/compactor shall illuminate the "FAULT" light on LCP-500 and signal a "FAULT" condition to the plant SCADA. After clearing a "FAULT" condition, the operator may reset for normal operation by pressing the "RESET" pushbutton on LCP-500.

4. The Washer-Compactor control system (Comp-500) shall provide outputs as shown on the P&IDs to allow monitoring of the washer-compactor operation by the plant SCADA system.

5. Final wiring and termination of output signals from the washer-compactor to the existing remote terminal unit shall be the responsibility of the contractor under specification Section 40 61 13 – Process Control System General Provisions.

6. Updates to existing plant SCADA system to incorporate the specified monitoring inputs shown on the P&IDs and provide operator interface displays shall be the responsibility of the contractor under specification Section 40 68 00.13 – Process Control Software (Modify).

3.04 GAS DETECTION SYSTEM

A. Process Overview

The process area is monitored for potentially hazardous conditions posed by high concentrations of hazardous gases, low oxygen content of the ambient air or loss of ventilation which may allow the buildup of hazardous conditions. The status of the conditions within the area are displayed for operator information by the use of green and red "Go / No-Go" status lights within the area and at entry doors.

B. Three gas detection sensors/transmitters located in the mechanical screen room and three gas detection sensors/transmitters located in the washer/compactor room shall monitor the area for gas concentrations which may be hazardous. The three sensors / transmitters shall monitor for:

1. Combustible gasses, primarily methane

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2. Ambient oxygen levels

3. Hydrogen Sulfide (H_2S)

C. Several gas alarm panels shall be located at strategic locations within the area and at each entry door to notify operations personnel of the status of the gas detection system. If no hazardous condition is detected, a green “GO” status light will be illuminated to indicate that the area is safe to enter.

D. Each of the six gas detection transmitters shall report to the gas detection alarm panel where the measured concentration will be monitored and compared to alarm setpoints. The gas detection alarm panel shall display the reported gas concentration on the face of the panel for operator information. If a transmitter signal exceeds the alarm setpoint, the gas detection alarm panel shall signal a “common alarm” condition to the gas detection relay panel and the plant SCADA system. In addition, the gas detection alarm panel will actuate a separate relay output to the SCADA system to identify which of the monitored transmitters has gone into an alarm condition. The gas detection alarm panel will illuminate alarm lights and initiate an audible alarm buzzer to notify the operator at the panel that an alarm condition has been detected. The alarm lights and buzzer will continue operation until acknowledged by the operator pressing the acknowledge pushbutton on the face of the panel.

E. The gas detection system will also monitor internal diagnostics and the overall level of the six transmitter signals and shall signal the SCADA system of a “Trouble” condition if issues are detected.

F. Upon receipt of a “common alarm” condition from the gas detection alarm panel, or a low supply/exhaust air flow condition in the screen room, the gas detection alarm relay panel will extinguish the green “GO” status lights and initiate audible alarm horns/buzzers and illuminate red “No-Go” lights at various alarm panels located at strategic places within the facility and at entry doors into the area. Due to the operation of the odor control system, low exhaust air flow condition is indicated by low flow alarm indication from both the exhaust fan and the odor control exhaust fan.

G. The operator shall press a separate “Reset” pushbutton on the alarm relay panel to reset the alarm lights and horns after an event involving either gas concentration or loss of adequate ventilation.

3.05 UNIT HEATERS

A. Process Overview

The PLC shall monitor the status of the plant generator and energize a discrete output indicating that the generator is operating. This discrete output will energize a trip relay which will initiate a hardwired interlock to the unit heaters in the screen room to shutdown. The PLC shall monitor the unit heaters trip relay and alarm to notify the

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operators that the unit heaters are not operable. Once the plant generator secures from operation, the operators will manually reset the unit heaters to re-enable their operation.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 40 62 63
OPERATOR INTERFACE TERMINALS (OIT)

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, test, install and place in satisfactory operation all operator interface terminals, with all spare parts, accessories, and appurtenances as herein specified and as shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 40 61 13 – Process Control System General Provisions

B. Section 40 63 43 – Programmable Logic Controllers

PART 2 – PRODUCTS

2.01 OPERATOR INTERFACE TERMINAL – LARGE

A. An Operator Interface Terminal (OIT) shall be provided to view and change PLC monitoring and control parameters and to display alarm messages using a graphical user interface. The OIT shall provide the following features as a minimum:

1. Minimum of 10.4 inch diagonal display
2. 18-bit color TFT LCD 800 x 600 SVGA display
3. Backlit analog resistive touch screen interface w/ 1 million press actuation rating
4. Backlight w/ min. 50,000 hour life to half brightness
5. Minimum of 512 MB internal storage
6. Minimum of 512 MB RAM application memory
7. Minimum of 80 MB nonvolatile user memory
8. Battery-backed real-time clock
9. Secure Digital (SD) card slot w/ min. 2 GB card
10. One USB 2.0 high-speed Type A host port; one USB 1.0 high-speed Type B device port
11. One 10/100Base-T Auto MDI/MDI-X Ethernet port
12. Windows-based configuration software complete with download cable

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13. Operating Voltage: 120 VAC or 24 VDC (internal or via independent power supply)

14. Enclosure Rating: NEMA 12/4X to match the associated PLC cabinet rating

15. Environment: 0-55°C, 5-95% relative humidity, non-condensing

B. The operator interface terminal shall be Allen-Bradley PanelView Plus 7 Standard 1000, or approved equal.

PART 3 – EXECUTION

3.01 REQUIREMENTS

A. The OIT shall be configured to display all PLC I/O, setpoints, and parameters. All equipment failures shall be alarmed. PLC I/O values and operator-entered setpoints shall be displayed with associated engineering units and service descriptions. Menus shall be provided to navigate between screens of different equipment items. Displays shall be arranged in a hierarchical structure with displays for specific equipment items grouped together. Additional functionality shall be as specified elsewhere in this Division.

B. All necessary configuration and programming software shall be provided on optical media and turned over to the Owner.

C. Unless otherwise indicated, each OIT shall be mounted between 48 and 60 inches above the floor or work platform.

D. Refer to Section 40 61 13 – Process Control System General Provisions, for additional requirements.

END OF SECTION

SECTION 40 63 43
PROGRAMMABLE LOGIC CONTROLLERS (PLC)

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, test, install and place in satisfactory operation all programmable logic controllers (PLC), with all spare parts, accessories, and appurtenances as herein specified and as shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 40 61 13 – Process Control System General Provisions

B. Section 40 67 00 – Control System Equipment Panels and Racks

1.03 TOOLS, SUPPLIES AND SPARE PARTS

A. Tools, supplies and spare parts shall be provided as specified in Section 40 61 22 – Tools, Supplies, and Spare Parts. In addition, the following specific spare parts items shall be provided:

1. One of each type and size of module for PLC equipment furnished under this Contract.

2. One of each type and size of PLC and equipment power supply furnished under this Contract.

PART 2 – PRODUCTS

2.01 PROGRAMMABLE LOGIC CONTROLLERS - GENERAL

A. The instrumentation subcontractor shall furnish programmable controller (PLC) components as specified herein and as shown on the Drawings. PLC components shall be compatible with the existing RTU-1 PLC hardware and software and shall be provided with all accessories and appurtenances as required to provide all features and functions as described herein. Refer to Rockland Country drawing 2105007-A1 for additional details of existing RTU-1 PLC. No substitutions will be permitted.

B. The existing RTU-1 PLC and I/O subsystems shall remain in service. The existing RTU-1 PLC is as follows:

1. Allen-Bradley CompactLogix model 5069-L320ER

2. Allen-Bradley Discrete Input module 5069-IB16

3. Allen-Bradley Analog Input module 5069-IF8

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4. Allen-Bradley CompactLogix Right End Cap

5. Allen-Bradley Compact 5000 6 & 4 Screw RTB

6. Allen-Bradley Compact 5000 18 Screw RTB

2.02 PROCESSORS

A. The existing RTU-1 processor and I/O cards shall remain in service providing control functions to variouos systems.

B. The instruction set for the PLC shall conform to the requirements of IEC 61131-3. Each PLC shall have the capability to run all five of the standard IEC 61131-3 languages simultaneously. These five languages shall be:

1. Ladder Diagram

2. Structured Text

3. Instruction List

4. Function Block Diagram

5. Sequential Function Chart

C. Additional co-processors or modules may be necessary and shall be furnished as required to meet the functions specified herein and in Section 40 61 96 – Process Control Descriptions.

D. PLC processors shall be provided with substantial user program, data and logic memory to allow for future expansion of the overall system. The total memory used on each processor shall be less than 60% of available memory at project completion.

2.03 COMMUNICATIONS

A. The existing ethernet switch intalled in RTU-1 shall provide PLC communications to vendor supplied PLCs as shown on the drawings.

B. In addition to a communications port for the control system network, communication ports shall be provided for any other devices required (i.e., operator interface unit) plus an additional communication port for connection to a notebook computer.

C. The PLC shall be able to support various types of fieldbus communication systems for data links to field instruments (where specified) in addition to connected equipment such as power monitors, VFDs, motor protection monitors, etc. As a minimum, Profibus DP, Foundation Fieldbus, Modbus RTU Master and Slave, TCP/IP Ethernet shall be supported. The Contractor shall coordinate the efforts of the necessary parties (instrumentation subcontractor and equipment suppliers) to accomplish the required

device and data table addressing between each PLC and the associated connected equipment.

D. Additional ethernet switches, communication modules or protocol gateways may be required to support specific communication protocols required under this Contract and shall be supplied at no extra cost to the Owner.

2.04 INPUT/OUTPUT SUBSYSTEMS

A. Input/output hardware shall be plug-in modules in associated I/O backplane/chassis or DIN-rail mounting assemblies. Each unit shall handle the required number of process inputs and outputs plus a minimum of 10 percent active pre-wired spares for each I/O type furnished, plus a minimum of 20 percent spare I/O module space for the addition of future circuit cards or modules.

B. Discrete inputs shall be Rockwell Automation model 5069-IB16, 24 VDC from dry field contacts to match existing discrete inputs in RTU-1. Electrical isolation shall be provided where required.

C. If required, analog inputs shall be Rockwell Automation model 5069-IF8, 24 VDC, differential from 4-20 mA transmitters to match existing analog inputs in RTU-1. Electrical isolation shall be provided where required.

D. Remote PLCs shall communicate with the RTU-1 PLC using the PLC manufacturer’s standard protocol or an open standard network such as DeviceNet, Ethernet IP, ProfiNet, Foundation Fieldbus, Modbus TCP/IP, or equal.

2.05 PROGRAMMING SOFTWARE

A. The PLC programming and configuration software shall be the manufacturer's latest, full-featured version, Windows-based, and shall be fully compliant with IEC 61131-3 standards. The software package shall consist of all programming, configuration, and documentation software needed to place the control and information system in satisfactory operation. The software shall allow on-line and off-line program development and documentation. PLC programming software shall include documentation on optical media.

B. A minimum of one copy of the PLC programming software shall be purchased by the instrumentation subcontractor and registered to the Owner.

C. The configuration and programming software shall support communication over the existing PLC network. All configuration and programming software necessary to implement this functionality shall be provided by the contractor.

PART 3 – EXECUTION

3.01 REQUIREMENTS

A. PLC programming shall be furnished to perform incorporate all functions described in Section 40 61 96 – Process Control Descriptions, including global functions into the existing PLC programs and functions. In addition, PLCs shall be programmed to provide additional functions described in other Sections of this Division.

B. PLC programming shall make use of the various IEC languages as appropriate to the specific task and shall be performed in a modular style making extensive use of program blocks (subroutines) and program variables to be passed to the program blocks for specific equipment. It is the intent of this requirement to allow for enhanced readability and ease of modification of the program code through the elimination of multiple instances of repeated code for the same function in a “hard-coded” style.

C. Extensive comments shall be placed in the program code to describe the functions of all elements of the program code. PLC code that does not contain comments shall be rejected.

D. Refer to Section 40 61 13 – Process Control System General Provisions, Part 3 for additional requirements.

3.02 REQUIREMENTS FOR MANUFACTURER-SUPPLIED PLCS

A. PLCs that are supplied for equipment local control panels by individual equipment manufacturers or suppliers shall, where so indicated on the Control System Architecture Drawing, be integrated into the plant control system and interfaced to the existing RTU-1 PLC. The manufacturer-supplied PLC shall be furnished, installed and programmed by the manufacturer. The PLC shall continuously monitor and control the associated system and at the same time shall provide all the required alarms, indications of system parameters, equipment status, etc. to the main control system at the plant.

B. Where required as described above, each manufacturer-supplied PLC shall be connected to the existing Ethernet process control network for communication to the existing RTU-1 PLC.

C. Where indicated on the drawings and/or required for system operation, each manfuacturer supplied PLC shall provide I/O as required to control and monitor other vendor supplied systems to ensure proper overall system operation.

D. Each equipment manufacturer shall provide all monitoring and control data to be transferred between the PLC and the plant control system in contiguous blocks of PLC registers to facilitate block read and write commands for efficient scanning by the control system SCADA servers. These contiguous registers shall be arranged in a single data transfer area, which shall be divided into eight distinct areas with an emphasis on flexibility and future expansion. The distinct areas shall be arranged by data type (analog

or discrete), transfer direction (server to PLC or PLC to server), and, where applicable, implementation schedule (current or future). Where required, peer-to-peer communication between PLCs shall likewise be accomplished using separate blocks of contiguous registers. Where individual equipment PLCs are not required to be connected to the plant control system via the data highway network or where shown on the drawings, they shall provide the individual hardwired signals as specified in the Contract Documents. Data and commands for connection to the control system are described in the Drawings, the Input/Output Schedule, the individual equipment Specification Sections, and in Section 40 61 96 – Process Control Descriptions.

E. The operator interface for control of each individual system shall be performed by local operator interface units as specified in Section 40 62 63 – Operator Interface Terminals or individual pilot devices on the equipment local control panel, as specified in the associated equipment Specification Section. Additional operator interface functions shall be provided through the plant control system as specified in the respective equipment specifications and in Section 40 61 96 – Process Control Descriptions.

F. Where operator interface and control functions are required to be provided through the plant control system, the individual system supplier shall be responsible for coordination with the instrumentation subcontractor to provide a complete and working equipment control system. The individual equipment supplier shall also be responsible for limiting the access of the plant control system to the equipment PLC code so as to prevent malfunctions of the equipment and any failure to continuously perform its intended functions. The equipment supplier shall be responsible for ensuring that no actions by the plant control system can damage or otherwise adversely affect the operation of the associated equipment or the safety of personnel working on or near that equipment. The equipment supplier shall also provide direction in the configuration of the SCADA software's security system by the instrumentation subcontractor to limit access to the control functions of the equipment control system to authorized personnel only. The equipment supplier shall coordinate testing of the completed system with the instrumentation subcontractor, which shall conform to the requirements of Section 40 61 21.72 – Field Testing.

G. The Contractor, equipment supplier and instrumentation subcontractor shall coordinate testing and startup of the equipment provided by the equipment supplier with the plant control system, including but not limited to the following tasks:

1. Provide assistance with control system testing of inputs, outputs, and control strategies as needed.

2. Provide support or interface work necessary to perform physical checkout and field testing to the final field devices. The schedule may require the instrumentation subcontractor and equipment manufacturer personnel to perform loop checks simultaneously, as directed by the Engineer.

3. Coordinate and assist as needed to maintain I/O connectivity throughout the system.

4. Ensure personnel safety while equipment is exercised via the plant control system.

5. Ensure that process, instrumentation, and control equipment are not damaged while equipment is exercised via the plant control system.

6. Provide temporary modifications to field devices and their terminations, if needed.

7. Providing labor and supervision, which may include, but is not limited to, the following: electricians, instrument technicians, manufacturer's representatives, and individual(s) knowledgeable about process startup and operation.

8. Operation of process equipment for verification of each plant control system input and output.

END OF SECTION

SECTION 40 67 00

CONTROL SYSTEM EQUIPMENT PANELS AND RACKS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, test, install and place, in satisfactory operation the control enclosures, with all spare parts, accessories, and appurtenances as specified herein and as shown on the Drawings.

B. Control enclosures shall be assembled, wired, and tested in the instrumentation subcontractor's own facilities, unless specified otherwise. All components and all necessary accessories such as power supplies, conditioning equipment, mounting hardware, signal input and output terminal blocks, and plug strips that may be required to complete the system shall be provided.

C. Either manufacturer’s standard or custom enclosures may be furnished subject to the requirements of the Contract Documents and favorable review by the Owner.

D. Due consideration shall be given to installation requirements for enclosures in new and existing structures. The Contractor shall examine plans and field inspect new and existing structures as required to determine installation requirements and shall coordinate the installation of all enclosures with the Owner and all affected contractors. The Contractor shall be responsible for all costs associated with installation of enclosures, including repair of damage to structures (incidental, accidental or unavoidable).

E. The terms enclosure, cabinet, and panel shall be considered the same product and are used interchangeably.

1.02 SUBMITTALS

A. Submittals shall be per Section 40 61 15 – Process Control System Submittals.

B. Thermal calculations.

C. Proof of circuit breaker selective coordination.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Section 40 61 13 – Process Control System General Provisions

B. Section 40 78 00 – Panel Mounted Instruments

C. Section 40 78 56 – Isolators, Intrinsically-Safe Barriers, and Surge Suppressors

D. Section 40 70 00 – Instrumentation for Process Systems

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E. Refer to Division 26 for additional requirements for conductors, circuit breakers, disconnect switches, etc.

1.04 PANEL LOCATION AND TYPE

A. For locations inside buildings in areas other than climate controlled (i.e., heated and air conditioned) electrical or control rooms, panel shall be Type 316 stainless steel NEMA 4X construction, or as indicated for hazardous area classification (Class, Division, at a minimum), or submersible, NEMA 6, applications. Epoxy coated cast copper-free aluminum construction shall also be acceptable for NEMA 4, 6 and 7 applications.

B. For locations in storage/feed areas for chlorine or other applicable corrosive chemicals, panel shall be of non-metallic construction, rated NEMA 4X, and be fully compatible with the associated chemical.

C. For locations within climate controlled (i.e., heated and air-conditioned) electrical or control rooms, panel shall be a painted steel fully enclosed NEMA 12 units with gasketed doors.

D. For outdoor locations, panel shall be Type 316L stainless steel NEMA 4X construction unless located in chlorine environments. Chlorine environment shall be nonmetallic NEMA 4X construction.

1.05 TOOLS, SUPPLIES AND SPARE PARTS

A. Tools, supplies and spare parts shall be provided as specified in Section 40 61 22 – Tools, Supplies and Spare Parts, General.

PART 2 – PRODUCTS

2.01 CABINETS AND PANELS

A. Cabinets and panels shall be formed or welded construction, reinforced with Unistrut, Powerstrut, or equal to facilitate mounting of internal components or equipment. Sufficient access plates and doors shall be provided to facilitate maintenance and testing of the cabinet's equipment. Doors shall be removable. Cabinets and panels with any dimension 36 inches or greater shall be provided with removable lifting lugs designed to facilitate safe moving and lifting of the panel during installation. All doors shall be fitted with common-keyed locks.

B. Cabinets and panels shall be minimum 14 USS gauge. Cabinets and panels with any dimension greater than 36 inches shall be 12 USS gauge.

C. Cabinets and panels shall have doors on the front and shall be designed for front access. NEMA 12 cabinets shall be fitted with three-point door latches. Doors for NEMA 4X cabinets shall be all stainless steel with three-point latches. Door hardware on NEMA

4X cabinets located in chemical storage/feed areas shall be non-corrosive in that environment.

D. Panels and cabinets located outside fence-secured areas shall be fitted with padlockable latch kits. Coordinate keying with Owner.

E. All cabinets and panels shall be provided with drawing pockets for as-built panel drawings. One copy of the appropriate panel as-built drawings shall be furnished and left in the pocket of each panel.

F. Panels with any dimension greater than 36 inches that contain a programmable controller (PLC) shall be provided with a folding laptop programmer shelf on the inside of the door. When deployed, the laptop shelf shall not be greater than 48 inches above finished floor. Laptop shelf shall be fitted to door with factory applied weld-studs. Weld discoloration and enclosure penetrations will not be accepted.

G. Unless otherwise noted, panel-mounted control devices (OIUs, hand switches, etc.) requiring operator access shall be mounted between 48 and 60 inches above the floor or work platform.

H. Cabinets and panels shall be prefabricated cabinets and panels by Hoffman or Saginaw Control and Engineering (SCE). The Contractor may optionally provide cabinets that are custom-fabricated by the instrumentation subcontractor or by a reputable panel fabrication shop acceptable to the Engineer.

2.02 FIELD PANELS

A. Field panels for outdoor service shall be suitable for wall or pipe mounting. Panels shall have the following features:

1. Hinged and foamed-in-place continuous gasketed door(s). Door material shall match enclosure and shall have piano hinge(s) and three-point latches.

2. Field panels located outside fence-secured areas shall be fitted with staple and hasp. Provide padlock and coordinate keying with Owner.

3. Thermal insulation and thermostatically controlled space heaters where required to prevent condensation or maintain environmental conditions for installed components.

4. External sun shields or shades constructed of the same materials as the associated enclosure, unless otherwise specified. Sun shield or shade shall be fitted to enclosure supports and not to enclosure. Sun shield or shade shall have a slightly sloped top to shed water and shall extend past the front of the enclosure by at least 6 inches and extend down the side and back of enclosure.

B. All external sample/process piping, including valves and appurtenances, shall be insulated with weather-proof insulation and heat-taped to prevent freezing. Heat taping shall be thermostatically controlled and self-regulating, and shall adjust its heat output to the temperature of the lines. Heat tape shall be powered from an equipment-safety GFCI circuit from within panel, unless otherwise shown or specified.

C. Field panels shall be adequately sized to house instruments, power supplies, surge protection, and appurtenant equipment required for operation. Sufficient space shall be provided for servicing instruments without removal of equipment from the enclosure.

D. Field panels shall be as manufactured by Hoffman, Saginaw Control & Engineering (SCE), or equal.

2.03 TERMINAL BLOCKS

A. Terminal blocks shall be assembled on non-current carrying galvanized steel DIN mounting rails securely bolted to the cabinet subpanel. Terminals shall be of the screw down pressure plate type as manufactured by Buchanan, Phoenix Contact, Weidmuller, Wieland, Square D, or equal.

1. Terminal blocks installed in the existing PLC-RTU1 panel shall match the size, rating, style, etc. of the existing terminal blocks in the same service to the extent possible.

B. Power terminal blocks for both 120 VAC and 24 VDC power shall be single tier with a minimum rating of 600 volts, 30 amps.

C. Signal terminal blocks shall be single tier with a minimum rating of 600 volts, 20 amps.

2.04 NAMEPLATES

A. Items of equipment installed in control panels shall be identified with nameplates. Each nameplate shall be located so that it is readable from the normal observation position and is clearly associated with the device or devices it identifies. Nameplates shall be positioned so that removal of the device for maintenance and repair shall not disturb the nameplate. Nameplates shall include, as necessary, the equipment identification number, description, calibrated range, and set point(s). Abbreviations of the description shall be subject to the Engineer's approval.

B. Nameplates shall be made of 1/16-inch thick machine engraved laminated phenolic plastic having white numbers and letters not less than 3/16-inch high on a black background. Nameplates attached to instruments may be black laser etched 1/8-inch high text on stainless steel with sharp edges made smooth. Stamped text shall not be acceptable.

C. Nameplates shall be attached to metal equipment by NEMA rated stainless steel screws and to other surfaces by an epoxy-based adhesive that is resistant to oil and moisture. In

cases where the label cannot be attached by the above methods, it shall be drilled and attached to the associated device by means of a braided stainless steel wire affixed with a permanent crimp.

D. Submit sample nameplate of each type.

PART 3 – EXECUTION

3.01 FABRICATION

A. The cabinet itself and all interior and exterior equipment shall be identified with nameplates. The equipment shall be mounted such that service can occur without removal of other equipment. Face mounted equipment shall be flush or semi-flush mounted with flat black escutcheons. All equipment shall be accessible such that adjustments can be made while the equipment is in service and operating. All enclosures shall fit within the allocated space as shown on the Drawings.

B. Enclosures shall provide mounting for power supplies, control equipment, input/output subsystems, panel-mounted equipment and appurtenances. Ample space shall be provided between equipment to facilitate servicing and cooling.

C. Enclosures shall be sized to adequately dissipate heat generated by equipment mounted inside the panel. If required, one or more of the following shall be provided to facilitate cooling:

1. For NEMA 12 cabinets only, louvered openings near the bottom and top or thermostatically controlled, low-noise cooling fans to circulate outside air into the enclosure, exhausting through louvers near the top of the cabinet. Air velocities through the enclosure shall be minimized to assure quiet operation.

2. Thermostatically controlled, low noise internal air blowers to circulate air within the enclosure, maintaining a uniform internal temperature. Initial setpoint shall be 75 degrees F.

3. All intake openings in cabinets and panels shall be fitted with dust filters.

D. Enclosures shall be constructed so that no screws or bolt heads are visible when viewed from the front. Punch cutouts for instruments and other devices shall be cut, punched, or drilled and smoothly finished with rounded edges.

E. The temperature inside each enclosure containing digital hardware (e.g., PLC, computer, Ethernet switch) shall be continuously monitored and shall generate an alarm to the nearest PLC if the temperature rises to an adjustable, preset high temperature. This thermostat shall be independent and separate from the thermostat used to control the temperature in the enclosure described above. Enclosure “high interior temperature” alarm shall be displayed on the HMI or OIT.

F. Intrusion alarm switches shall be provided on all enclosures containing digital hardware and shall generate an alarm to the nearest PLC when any enclosure door is opened. If panel contains a service light, alarm switch shall also be wired to turn light on when door is opened.

G. Terminals shall be marked with a permanent, continuous marking strip. One side of each terminal shall be reserved exclusively for field incoming conductors. Common connections and jumpers required for internal wiring shall not be made on the field side of the terminal. Subject to the approval of the Engineer, a vendor's pre-engineered and prefabricated wiring termination system will be acceptable.

H. Wiring within cabinets, panels, and consoles shall be installed neatly and shall comply with accepted standard instrumentation and electrical practices. Power, control and signal wiring shall comply with Division 26 of the Specifications, except that the minimum wire size for discrete signal wiring may be 16 AWG, and for analog wiring may be 18 AWG. For each pair of parallel terminal blocks, the field wiring shall be between the blocks.

I. Separate terminal strips shall be provided for each type of power and signal used within each cabinet. Where applicable, terminal strips for different voltages of discrete signal wiring shall also be separated. Terminal strips shall be labeled as to voltage and function.

J. All wiring shall be bundled and run open or enclosed in vented plastic wireway as required. Wireways shall be oversized by a minimum of 10%; overfilled wireways shall not be acceptable. All conductors run open shall be bundled and bound at regular intervals, not exceeding 12 inches, with nylon cable ties. Care shall be taken to separate electronic signal, discrete signal, and power wiring when operating at differing voltages.

K. Spare field wiring shall be bundled, tied, and labeled as specified above, and shall be neatly coiled in the bottom of the cabinet.

L. All installed spare I/O hardware shall be wired along with live I/O wiring to the field wiring terminal blocks within the cabinet. Where space for spare I/O modules has been provided with the PLC backplane or DIN-rail mounting system, corresponding space for wiring, surge protection, and terminations shall be furnished within the cabinet.

M. A copper ground bus shall be installed in each cabinet and shall be connected to the building power ground.

N. Interior panel wiring shall be tagged at all terminations with machine-printed self-laminating labels. Labeling system shall be Brady TLS 2200 Printer with TLS 2200®/TLS PC Link™ labels, or equivalent system by Seton or Panduit.

O. Wires shall be color coded as follows:

1. Equipment Ground – GREEN

2. 120 VAC Power – BLACK
3. 120 VAC Power Neutral – WHITE
4. 120 VAC Control (Internally Powered) – RED
5. 120 VAC Control (Externally Powered) – YELLOW
6. 24 VAC Control – ORANGE
7. DC Power (+) – RED
8. DC Power (-) – BLACK
9. DC Control – BLUE
10. Analog Signal – BLACK/WHITE or BLACK/RED

P. Enclosures shall be provided with a main circuit breaker and a circuit breaker on each individual branch circuit distributed from the panel. Main breaker and branch breaker sizes shall be coordinated such that an overload in a circuit will trip only its immediate breaker and not the upstream breaker.

Q. Enclosures with any dimension larger than 36 inches shall be provided with 120-volt duplex receptacles for service equipment and LED service lights. Power to these devices shall be independent from the PLC power supply and its associated uninterruptible power system.

R. Where applicable, enclosures shall be furnished with red laminated plastic warning signs in each section. The sign shall be inscribed "WARNING - This Device Is Connected to Multiple Sources of Power." Letters in the word "WARNING" shall be 0.75 inch high, white.

S. The interconnection between equipment and panel shall be by means of flexible cables provided to permit withdrawal of the equipment from the cabinet without disconnecting the plugs.

3.02 PAINTING/FINISHING

A. All steel enclosures shall be free from dirt, grease, and burrs and shall be treated with a phosphatizing metal conditioner before painting. All surfaces shall be filled, sanded, and finish coated by spraying a 1-2 mil epoxy prime coat and smooth, level, high grade textured finish between flat and semi-gloss shine. The colors shall be selected by the Owner from a minimum of six color samples provided.

B. Materials and techniques shall be of types specifically designed to produce a finish of superior quality with respect to adherence, as well as impact and corrosion resistance.

C. Panels fabricated from stainless steel shall not be painted.

D. Panels fabricated from non-metallic materials (e.g., FRP) shall be gel-coated and shall not be otherwise painted.

3.03 INSTALLATION

A. Refer to Section 40 61 13 – Process Control System General Provisions for additional requirements.

END OF SECTION

SECTION 40 67 63
UNINTERRUPTIBLE POWER SYSTEMS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, test, install and place in satisfactory operation all uninterruptible power systems, with all spare parts, accessories, and appurtenances as herein specified and as shown on the Drawings.

B. One UPS shall be provided for each operator workstation and its peripherals (i.e. printer, network equipment, radio, etc.) provided under this Contract.

C. One UPS shall be provided for each programmable logic controller (PLC) panel or remote telemetry unit (RTU) and its appurtenant equipment provided under this Contract. However, courtesy receptacles in PLC and RTU cabinets shall not be powered by the UPS.

D. UPS units shall be mounted in or near enclosures containing digital hardware, unless otherwise specified or shown on the Drawings, as follows:

1. UPS units for operator's consoles shall be mounted within the consoles.

2. UPS units for control panels containing PLCs shall be mounted either within the cabinet or in an adjacent cabinet of suitable environmental rating.

3. UPS units for RTUs shall be mounted within the RTU cabinet.

E. Where the UPS is mounted within a dedicated enclosure, that enclosure shall be properly sized for heat dissipation and all other applicable requirements as specified in Section 40 67 00 – Control System Equipment Panels and Racks and its subordinate Sections.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 40 61 13 – Process Control System General Provisions

1.03 SUBMITTALS

A. Sizing calculations, in Watts (W) or Volt-Amps (VA), for all UPS units.

B. Heat dissipation calculations for all enclosures that contain a UPS unit.

C. Run time calculation.

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PART 2 – EQUIPMENT

2.01 UNINTERRUPTIBLE POWER SYSTEMS

A. Each UPS shall consist of a freestanding UPS module and battery modules as required to meet backup run time requirements.

B. UPS units shall be true on-line type. Each UPS shall be sized to match the maximum power requirements of the associated digital equipment, control panel power supplies and accessories. Under normal operation, the AC power shall be converted to DC. The DC power from the battery charger shall supply an inverter and maintain the battery module at full charge. The AC output from the inverter shall be fed to the associated digital equipment power supply unit and/or other equipment power supplies as appropriate. Upon loss of the AC supply, the inverter shall continue to supply normal power to the device, drawing DC from the batteries.

C. An automatic bypass switch shall be provided with UPS units of greater than 2 kVA capacity. The transfer switch shall be of the solid state, make-before-break type and shall automatically transfer load from the inverter to the AC line in the event of an inverter malfunction. The total transfer time shall be 5 milliseconds or less. The transfer switch shall be provided with a manual override.

D. A manually operated maintenance bypass switch shall be provided for each UPS installation, other than for computers, to allow the hardware to be powered while the UPS is removed for maintenance. The bypass switch shall be the make-before-break type to ensure continuous power to the load.

E. Loss of AC power shall be monitored on the line side of the UPS and reported via normally closed (fail safe) unpowered contacts to the associated PLC/RTU.

F. Each UPS shall meet the following requirements:

1. Input voltage shall be 117 VAC, single phase, 60 Hz.

2. Voltage regulation shall be +/-5 percent for line and load changes.

3. The output frequency shall be phase-locked to the input AC line on AC operation and shall be 60 hertz +/-0.5 percent when on battery operation.

4. The batteries shall be of the sealed, lead acid or lead calcium gelled electrolyte type, or VRLA absorbed glass mat (AGM) type. The battery modules shall have a minimum full load backup time of 30 minutes for PLC-based control panels, and 45 minutes for remote telemetry units.

5. The UPS capacity shall be sized for 150% of the connected load.

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6. A status monitoring and control panel shall be provided and shall include the following:

    a. Status indicating lights for both normal and abnormal conditions.

    b. Individual alarm contacts that shall close upon:

        1) Loss of the AC line

        2) Low battery level

        3) Fault condition.

    c. Contacts shall be wired to the closest discrete input subsystem. Alternatively, an Ethernet, RS-232 or USB port shall provide UPS status to an operator workstation. All required interface software and hardware shall be provided.

    d. Circuit breaker for the AC input.

7. Sound absorbing enclosure.

8. EMI/RF noise filtering.

9. Surge protection shall be provided on the AC input circuit, which shall have a UL TVSS clamping voltage rating of 400 V with a <5 ns response time.

G. UPS systems shall be the 9PX series by Eaton, Smart-UPS On-line series by APC/Schneider-Electric, or equal.

PART 3 – EXECUTION

3.01 REQUIREMENTS

A. Where the UPS is mounted within the PLC or RTU cabinet, it shall not interfere with access to other equipment or wiring within the panel (i.e., it shall not be necessary to move or remove the UPS to remove or service other panel-mounted equipment). For floor-mounted PLC cabinets with bottom wiring access (including those cabinets with legs), the UPS shall be placed on a dedicated shelf within the cabinet.

B. Refer to Section 40 61 13 – Process Control System General Provisions for additional requirements.

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END OF SECTION

NO TEXT ON THIS PAGE

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SECTION 40 68 00.13
PROCESS CONTROL SOFTWARE (MODIFY EXISTING)

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, test, install, and place in satisfactory operation all control and information system software with all required programming and software appurtenances as herein specified and as shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 40 61 13 – Process Control System General Provisions

B. Section 40 61 93 – Control System Input/Output List

C. Section 40 61 96 – Process Control Descriptions

PART 2 – PRODUCTS - (NOT USED)

PART 3 – EXECUTION

3.01 OVERALL SYSTEM CONFIGURATION

A. The Owner's existing Human-Machine Interface (HMI) software, including but not limited to all relevant displays, alarm summary pages, data collection, and historical trending/reporting, shall be modified to include all work performed under this Contract.

B. Contractor shall verify manufacturer, model and revision of the Owner's existing Network, PLC, and HMI hardware and software and as well as the number, design and complexity of relevant displays, alarm summary pages, data collection and trending/reporting to ensure familiarity prior to bid.

C. The Owner's existing control system shall be modified to include the inputs and outputs as well as data communciation and exchanges specified in the Input/Output Schedule and in other Sections of this Division.

3.02 SOFTWARE MODIFICATIONS

A. All HMI software configuration performed under this Contract shall be coordinated with the Owner and shall match in all possible respects the "look and feel," in the opinion of the Engineer, of the existing SCADA System. Specified features and functions of this Contract that do not already exist, even if only for "look and feel," shall be provided. Details on how to best implement these features and functions shall be discussed with Owner and Engineer.

B. Modify the existing system network and communciations as required to allow seamless integration of the new equipment into the system and facilitate communication with the existing PLC/HMI and the new equipment.

C. Major HMI software scope of work shall include, but shall not be limited to, the following:

1. Create new graphic displays showing the new facilities and functions described herein complete with all associated equipment and instrumentation.

2. Modify the existing plant overview display(s) for the SCADA system to include the new facilities and equipment, and create links to the new screens.

3. Modify existing alarm summary pages to incorporate new monitoring data into the alarm displays.

4. Modify existing reports to include the additional monitoring points specified under this Contract.

5. Create new real-time and historical trends, and coordinate with the Owner appropriate grouping of the trend charts.

6. Update the system status display to include new hardware provided under this Contract.

D. Ladder logic resident in existing PLCs shall be modified to perform the functions described as specified herein and in Section 40 61 96 – Process Control Descriptions. Specifically, the existing PLCs shall be programmed to accept the I/O specified in Section 40 61 93 – Control System Input/Output List and to make this data readily available on the plant network and shall be programmed to execute the logic necessary to implement all control functions associated with the scope of work specified under this Contract.

E. All discrete and analog data acquisition, pre-processing, storage and process control functions shall be performed at the PLC level. The HMI software shall not be used for this purpose.

END OF SECTION

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SECTION 40 70 00
INSTRUMENTATION FOR PROCESS SYSTEMS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The instrumentation subcontractor shall furnish, install, test and place in operation instruments as scheduled together with all signal converters, transmitters, isolators, amplifiers, etc. to interface with the process control system as shown on the Drawings and as specified. The Contractor may elect to install sensors on process lines provided that the instrumentation subcontractor provides full on-site supervision during installation. Mounting of associated indicators, sensors, sampling pumps, power supplies, brackets and appurtenances shall be provided as indicated.

B. It is the intent of the Contract Documents that all process taps, isolation valves, nipples, penetrations, embedded instrumentation supports, conduit, wiring, terminations, and the installation of process instrumentation on process lines shall be provided under this Contract. The Instrumentation Subcontractor shall supervise installation of equipment provided where installation is by other Subcontractors or Contractors.

C. Tapping and connections for primary process sensors shall be sized to suit each individual installation and the requirements of the instrument served. The Contractor shall ensure that the location, supports, orientation and dimensions of the connections and tapping for instruments are such as to provide the proper bracing, the required accuracy of measurement, protection of the sensor from accidental damage and accessibility for maintenance while the plant is in operation. Isolation valves shall be provided at all process taps.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 40 61 13 – Process Control System General Provisions

B. Section 40 61 91 – Process Control System Instrument List

C. Section 40 67 00 – Control System Equipment Panels and Racks

D. Section 40 79 00 – Miscellaneous Instruments, Valves, and Fittings

E. Section 40 61 22 – Tools, Supplies, and Spare Parts, General

F. Instruments furnished with mechanical equipment shall be furnished, installed, tested and calibrated as specified elsewhere in the Contract Documents.

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1.03 TOOLS, SUPPLIES AND SPARE PARTS

A. Tools, supplies and spare parts shall be provided as specified in Section 40 61 22 -- Tools, Supplies, and Spare Parts, General.

B. Additional items as recommended by the analytical instrument manufacturers or as described for the specified analytical instrument sections shall be provided.

PART 2 – PRODUCTS

2.01 GENERAL

A. All instrumentation supplied shall be the manufacturer's latest design. Unless otherwise specified, instruments shall be solid state, electronic, using enclosures to suit specified environmental conditions. Microprocessor-based equipment shall be supplied unless otherwise specified. All instruments shall be provided with mounting hardware and floor stands, wall brackets, or instrument racks as shown on the Drawings, or as required.

B. Equipment installed in a hazardous area shall meet or exceed Class, Group, and Division requirements as shown on the Drawings, to comply with the National Electrical Code.

C. All field instrumentation for outdoor service shall be provided with enclosures that are suitable for outdoor service, as follows:

1. Where the manufacturer's enclosures are suitable for outdoor service, they shall be provided with instrument sunshades. Sunshades shall be Style E as manufactured by O'Brien Corporation, or equal. Where possible, these instruments shall be mounted in a north facing direction.

2. Where the manufacturer's standard enclosures are not suitable for outdoor service, instruments shall be mounted in Field Panels in accordance with Section 40 67 00 – Control System Equipment Panels and Racks, or may be furnished with Vipak instrument field enclosures as manufactured by O'Brien Corporation, equivalent by Intertec, or equal. It shall not be necessary to provide the manufacturer's NEMA 4 or 4X enclosures for instruments that will be subsequently mounted in separate field panels.

D. All instruments shall return to accurate measurement without manual resetting upon restoration of power after a power failure.

E. Unless otherwise shown or specified, local indicators shall be provided for all instruments. Where instruments are located in inaccessible locations, local indicators shall be provided and shall be mounted as specified in Paragraph 3.01 B herein. All indicator readouts shall be linear in process units. Readouts of 0 to 100% shall not be acceptable (except for speed and valve position). Isolated outputs shall be provided for all transmitters.

F. Unless otherwise specified, field instrument and power supply enclosures shall be Type 316 stainless steel, fiberglass (or similar, per Engineer’s judgement) or PVC coated copper-free cast aluminum NEMA 4X construction.

G. Where separate elements and transmitters are required, they shall be fully matched, and unless otherwise noted, installed adjacent to the sensor. Special cables or equipment shall be supplied by the associated equipment manufacturer.

H. Electronic equipment shall utilize printed circuitry and shall be coated (tropicalized) to prevent contamination by dust, moisture and fungus. Solid state components shall be conservatively rated for long term performance and dependability over ambient atmosphere fluctuations. Ambient conditions shall be -20 to 50 degrees C and 20 to 100 percent relative humidity, unless otherwise specified. Field mounted equipment and system components shall be designed for installation in dusty, humid, and corrosive service conditions.

I. All devices furnished hereunder shall be heavy duty type, designed for continuous industrial service. The system shall contain products of a single manufacturer, insofar as possible, and shall consist of equipment models that are currently in production. All equipment provided, where applicable, shall be of modular construction and shall be capable of field expansion.

J. All non-loop-powered instruments and equipment shall be designed to operate on a 60 Hz AC power source at a nominal 117 V, plus or minus 10 percent, except where specifically noted. All regulators and power supplies required for compliance with the above shall be provided. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.

K. All analog transmitter and controller outputs shall be isolated, 4 to 20 milliamps into a load of 0 to 750 ohms, unless specifically noted otherwise. All switches shall have double pole, double throw contacts rated at a minimum of 600 VA, unless specified otherwise.

L. Materials and equipment used shall be UL approved wherever such approved equipment and materials are available.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General

1. Equipment shall be located so that it is accessible for operation and maintenance. The instrumentation subcontractor shall examine the Drawings and shop drawings for various items of equipment in order to determine the best arrangement for the work as a whole and shall supervise the installation of process instrumentation supplied under this Division.

2. Work shall be performed in compliance with all applicable local codes and practices. Where the Contract Documents do not delineate precise installation

procedures, the latest version of the American Petroleum Institute (API) Recommended Practice 551 manual (API RP 551) shall be used as a guide to installation procedures.

B. Equipment Mounting and Support

1. Field equipment shall be wall mounted or mounted on two inch diameter pipe stands welded to a 10 inch square by 1/2 inch thick base plate unless shown adjacent to a wall or otherwise noted. Materials of construction shall be aluminum or 316 stainless steel. Instruments attached directly to concrete shall be spaced out from the mounting surface not less than 1/2 inch by use of phenolic spacers. Expansion anchors in walls shall be used for securing equipment or wall supports to concrete surfaces. Unless otherwise noted, field instruments shall be mounted between 48 and 60 inches above the floor or work platform.

2. Embedded pipe supports and sleeves shall be Schedule 40, Type 316 stainless steel pipe, ASA B 36.19, with stainless steel blind flange for equipment mounting, unless otherwise indicated.

3. Materials for miscellaneous mounting brackets and supports shall be Type 316 stainless steel construction.

4. Pipe stands, miscellaneous mounting brackets and supports shall comply with the requirements of Division 05 of the specifications.

5. Transmitters shall be oriented such that output indicators are readily visible.

C. Control and Signal Wiring

1. Electrical, control and signal wiring connections to transmitters and elements mounted on process piping or equipment shall be made through liquid tight flexible conduit. Conduit seals shall be provided where conduits enter all field instrument enclosures and all cabinetry housing electrical or electronic equipment.

3.02 ADJUSTMENT AND CLEANING

A. The instrumentation subcontractor shall comply with the requirements of Division 01 of these Specifications and all instrumentation and control system tests, inspection, and calibration requirements for all instrumentation and controls provided under this Contract and specified herein. The Engineer, or his/her designated representative(s), reserves the right to witness any test, inspection, calibration or start up activity. Acceptance by the Engineer of plans, reports, or documentation relating to testing or commissioning activity shall not relieve the Contractor of his/her responsibility for meeting all specified requirements.

B. The instrumentation subcontractor shall provide the services of factory trained technicians, tools and equipment to field calibrate, test, inspect and adjust each

instrument to its specified performance requirement in accordance with manufacturer's specifications and instructions. Instruments which fails to meet Contract requirements, or published manufacturer performance specification for functional and operational parameters, shall be repaired or replaced, at the discretion of the Engineer, at no cost to the Owner. The Contractor shall bear all costs and provide all personnel, equipment and materials necessary to implement all installation tests and inspection activities for equipment specified herein.

C. At least 60 days before the anticipated initiation of installation testing, the Contractor shall submit to the Engineer a detailed description of the installation test(s) to be conducted to demonstrate the correct operation of the instrumentation supplied hereunder.

D. Field instrument calibration shall conform to the following requirements:

1. The instrumentation subcontractor shall provide the services of factory trained instrumentation technicians, tools and equipment to field calibrate or verify factory calibration of each instrument supplied under this Contract and existing instruments shown to its specified accuracy in accordance with the manufacturer's specification and instructions for calibration. Calibration and verification shall take place under actual process conditions. Forcing outputs shall not be acceptable.

2. Each instrument shall be calibrated/verified at 0, 25, 50, 75 and 100 percent of span using test instruments to simulate inputs and read outputs. Test instruments shall be rated to an accuracy of at least five (5) times greater than the specified accuracy of the instrument being calibrated. Where applicable, such test instruments shall have accuracy’s as set forth by the National Institute for Standards and Technology (NIST).

3. The instrumentation subcontractor shall provide a written calibration/verification sheet to the Engineer for each instrument, certifying that it has been calibrated to its published specified accuracy. The Contractor shall submit proposed calibration sheets for various types of instruments for Engineer approval prior to the start of calibration. This sheet shall include but not be limited to date, instrument tag numbers, brief description of how the calibration process was performed, calibration data for the various procedures described herein, name of person performing the calibration, a listing of the published specified accuracy, permissible tolerance at each point of calibration, calibration reading as finally adjusted within tolerance, defect noted, corrective action required and corrections made. For electronic or powered instruments, the calibration/verification sheet shall also list all configurable parameters that have been modified from their default factory setting.

4. If doubt exists as to the correct method for calibrating or checking the calibration/verification of an instrument, the manufacturer's printed

recommendations shall be used as an acceptable standard, subject to the approval of the Engineer.

5. Upon completion of calibration, devices calibrated hereunder shall not be subjected to adjustments, sudden movements, accelerations, or shocks, and shall be installed in permanent protected positions not subject to moisture, dirt, and excessive temperature variations. Caution shall be exercised to prevent such devices from being subjected to over-voltages, incorrect voltages, overpressure or incorrect air. Damaged equipment shall be replaced and re-calibrated/verified at no cost to the Owner. Equipment that has been adjusted, modified, or moved or there is evidence of such activity shall be re-calibrated/verified at no cost to the Owner.

6. After completion of instrumentation installation, the instrumentation subcontractor shall perform a loop check. The Contractor shall submit final loop test results with all instruments listed in the loop. Loop test results shall be signed by all representatives involved for each loop test.

END OF SECTION

SECTION 40 71 79.16
FLOW SWITCHES (THERMAL)

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, test, install and place in satisfactory operation the thermal dispersion flow switches, with all spare parts, accessories, and appurtenances as herein specified and as shown on the Drawings.

B. Contractor shall be responsible for coordinating process line size to match capabilities of the selected instrument. In consultation with Engineer, small diameter line sizes shall be increased in size as required to meet velocity requirements of the instrument. At no additional cost, provide reducers and increase process line size in the same material in a straight segment of pipe for a length no less than manufacturer's recommended length of straight run.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 40 61 13 – Process Control System General Provisions

B. Section 40 70 00 – Instrumentation for Process Systems

PART 2 – PRODUCTS

2.01 THERMAL DISPERSION FLOW SWITCHES – INSERTION TYPE

A. Each flow switch shall utilize a thermal dispersion type, Type 316 stainless steel sensing element (probe), unless otherwise indicated, installed in the process piping/ductwork as indicated on the Drawings. Probe style shall be as determined by the manufacturer and based on the specific application.

B. Unless otherwise indicated or recommended by the manufacturer, the element insertion length shall be approximately one-third to one-half of the duct/pipe diameter plus allowance for mounting accessories. All mounting accessories shall be provided.

C. The electronics shall be mounted to the sensor, unless otherwise indicated. Power supply to the unit shall be 120 VAC, 60 Hz. Where remote mounted, manufacturer shall furnish a continuous length of cable between the sensor and the electronics.

D. The instrument shall be housed in a NEMA 4X (IP66) enclosure and shall be rated for a Class I, Division 1, GRP D, environment, per the Area Classification Drawings, when located in a hazardous area.

E. The unit shall have field configurable dual SPDT or single DPDT relay contacts rated 6 amps at 115 VAC for remote alarming to two different locations.

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F. Flow repeatability shall be +/-1 percent of setpoint range.

G. Flow response time shall be as low as 3 seconds.

H. The thermal dispersion flow switch shall be Fluid Components Model (FCI) FLT93 series, Sierra InnovaSwitch, Magnetrol Thermatel TD2 series, or equal.

PART 3 – EXECUTION

3.01 REQUIREMENTS

A. All threaded connections between stainless steel components shall be installed with process compatible anti-seize lubricant to prevent galling.

B. Refer to Section 40 70 00 – Instrumentation for Process Systems, for additional information

END OF SECTION

SECTION 40 72 23.01
RADAR LEVEL METERS – TWO WIRE

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, test, install and place in satisfactory operation the radar liquid level measurement systems, with all spare parts, accessories, and appurtenances as herein specified and as shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 40 61 13 – Process Control System General Provisions

B. Section 40 70 00 – Instrumentation for Process Systems

PART 2 – PRODUCTS

2.01 RADAR LEVEL TRANSMITTERS

A. Each radar level monitoring system shall include one radar level transmitter sensor with microprocessor-based signal conditioning.

B. Tank mounting applications shall include mounting flange adapter supplied by the manufacturer, which is compatible with the process liquid and the tank flange connection.

C. For open tank applications, the antenna shall be integral with the transmitter. Body mounting connection shall be 1-½" NPT. Mounting brackets, as required, shall be coordinated with tank supplier or Contractor as required to securely position the instrument.

D. For flange mounted applications, the transmitter shall be equipped with a horn antenna which extends the antenna sensing plane into the vessel / tank free area. Coordinate the length of the flange pocket with the length of the horn antenna. Minimum flange size shall be 3”.

E. The system shall be suitable for operating temperature range of -40 to +158 degrees F and pressure of full vacuum to 43.5 psi.

F. The level sensor shall operate on the W-band frequency (80 GHz). Sensor accuracy shall be a minimum of ±0.08 inches. Beam spread shall be 8 degrees or less.

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G. The transmitter shall include an integral or remote digital display, as scheduled, and operator interface that allows complete field configuration of all settings and control modes of the system.

H. Output level signal shall be linear, isolated 4-20 mA DC superimposed with a HART digital signal.

I. Power requirement for the transmitter shall be 24Vdc.

J. The units shall have a NEMA 4X housing of PBT plastic. Wetted parts shall be PVDF with FKM process seal.

K. All elements shall be Factory Mutual certified for use in Class 1, Division 1, Groups C and D.

L. System setup shall be by Bluetooth wireless technology, HART communicator or vendor supplied software communicating over the signal wiring.

M. Radar level measurement system shall be VegaPuls Series; Endress + Hauser Micropilot FMR Series; Siemens Sitrans LR Series, Emerson 1208 Series or equal.

PART 3 – EXECUTION

3.01 REQUIREMENTS

A. Refer to Section 40 70 00 – Instrumentation for Process Systems.

END OF SECTION

SECTION 40 72 76.26
LEVEL SWITCHES (FLOATS)

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, test, install and place in satisfactory operation the float level switches, with all spare parts, accessories, and appurtenances as herein specified and as shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 40 61 13 – Process Control System General Provisions

B. Section 40 70 00 – Instrumentation for Process Systems

PART 2 – PRODUCTS

2.01 LEVEL SWITCHES (FLOATS)

A. Level switches of the direct acting float-operated design shall be comprised of a hermetically sealed, approximately 5-inch diameter plastic casing float, containing microswitches and flexibly supported by means of a heavy neoprene or PVC jacket, with three-conductor cable a minimum of 20 feet in length. Unless otherwise specified, media specific gravity is 0.95 to 1.05. Microswitches shall be one normally open and one normally closed, 5A-115V AC capacity. Float hangers and supports shall be provided as shown on the installation detail drawings.

B. Float switches shall be Model ENM as manufactured by Flygt, or approved equal.

PART 3 – EXECUTION

3.01 REQUIREMENTS

A. Refer to Section 40 70 00 – Instrumentation for Process Systems.

END OF SECTION

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NO TEXT ON THIS PAGE

SECTION 40 73 13
PRESSURE AND DIFFERENTIAL PRESSURE GAUGES

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, test, install and place in satisfactory operation the pressure gauges, with all spare parts, accessories, and appurtenances as herein specified and as shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 40 61 13 – Process Control System General Provisions

B. Section 40 70 00 – Instrumentation for Process Systems

C. Section 40 79 00 – Miscellaneous Instruments, Valves, and Fittings

PART 2 – PRODUCTS

2.01 PRESSURE GAUGES

A. All gauges shall be designed in accordance with the ASME B40.1 entitled, "Gauges, Pressure, Indicating Dial Type - Elastic Element".

B. All gauges shall be direct reading type. Snubbers shall be provided on all gauges. Gauge full-scale pressure range shall be selected such that the maximum operating pressure shall not exceed approximately 75% of the full-scale range.

C. Features

1. Mounting: ½” NPT, lower stem mount type
2. Accuracy: 0.5% full scale
3. Case: Solid front, black phenolic material
4. Dial: White background and black letters
5. Glass: Shatterproof
6. Blow-out protection: Back
7. Pressure element: stainless steel bourdon tube
8. Movement: Stainless steel, Teflon coated pinion gear and segment
9. Gaskets: Buna-N

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D. Liquid-filled or equivalent mechanically-damped gauges shall be used if the gauges are installed with pumps, or where gauges are subjected to vibrations or pulsation. Filling fluid shall be silicone unless oxidizing agents such as sodium hypochlorite are present, where halocarbon shall be used.

E. Gauge size shall be 4-1/2".

F. Diaphragm seals and isolating ring seals shall be furnished in accordance with the requirements specified under Section 40 79 00 – Miscellaneous Instruments, Valves, and Fittings.

G. The complete gauge assembly and appurtenances shall be fully assembled and tested prior to field mounting. A ½" isolation stainless steel ball valve shall be provided for each gauge assembly.

H. Pressure and vacuum gauges shall be Ashcroft Duragauge Model 1279, Ametek-U.S. Gauge Division, H.O. Trerice Co., WIKA Instrument Corporation, or approved equal.

PART 3 – EXECUTION

3.01 REQUIREMENTS

A. Refer to Section 40 70 00 – Instrumentation for Process Systems.

END OF SECTION

SECTION 40 76 20
GAS MONITORING SYSTEMS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, test, install and place in satisfactory operation the Gas Monitoring Systems with all spare parts, accessories, and appurtenances as herein specified and as shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 40 61 13 – Process Control System General Provisions

B. Section 40 70 00 – Instrumentation for Process Systems

1.03 TOOLS, SUPPLIES AND SPARE PARTS

A. One spare sensor of each type used shall be provided.

B. Calibration equipment as recommended by the manufacturer and a one-year supply of calibration gas for each gas measured shall be provided to field calibrate the gas monitoring systems.

PART 2 – PRODUCTS

2.01 GENERAL

A. Gas monitoring systems shall include six separate sensors to monitor combustible gas, oxygen, and hydrogen sulfide; (two each) and a single microprocessor-based controller that is capable of accepting, converting and transmitting signals from the three sensors. The complete gas monitoring system including sensors, controller, and accessory equipment shall be supplied by a single manufacturer.

2.02 SENSORS

A. All sensors shall sample and monitor the atmosphere without the aid of pumps or other mechanical devices. Sensors and associated enclosures shall be classified as Class 1, Division 1, Group C and D as specified by the National Electric Code. Sensors shall be mounted with non-corrosive hardware as shown in the Drawings and/or as recommended by the manufacturer.

1. Combustible Gas Sensor – The combustible gas sensor shall be the infrared type and shall be resistant to poisoning by hydrogen sulfide and silicone. Default range 0 – 100% LEL.

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2. Oxygen Sensor – The oxygen sensor shall be the galvanic electrochemical type. Default range 0 – 25% O_2.

3. Hydrogen Sulfide Sensor – The hydrogen sulfide sensor shall be the polarographic electrochemical type. Default range 0 – 50 ppm H_2S.

B. Sensors shall be two or three wire, 4-20mA 24VDC output compatible with controller.

2.03 CONTROLLER

A. Controller shall be enclosed in a NEMA 4X enclosure, complete with a sealed window for viewing the status of the sensors. The controller shall have a digital readout to indicate the concentration of each of the gases (6 minimum) being monitored. The display shall sequentially show the concentration of each of the gases being measured. The controller shall have an individual warning, alarm, and fault indicating lights for each gas channel (6 minimum) and a green power light.

1. Two and three wire sensor input (4-20 mA) signals shall be supported for each gas being measured.

2. Two common alarm alarm and two common horn SPDT relays, rated, 5 amps resistive 120VAC/30VDC shall be provided.

3. A SPDT relay rated at 5 amps 120 VAC resistive shall be provided for each gas being monitored (6 minimum).

B. Two adjustable alarm set points shall be provided for each gas being monitored. When the alarm setting is exceeded for a specific gas, the specific alarm light and relay associated with that gas shall activate. The light and relay shall remain in the alarm state until the condition has cleared, and the alarm is manually reset. The alarm acknowledge button shall be mounted on the front of the device. An 85db audible alarm shall be activated when any gas alarm level is exceeded. The audible alarm shall be capable of being silenced by the acknowledge button. A front of device Test pushbutton shall provide test capability of the audbile alarm and lights. There shall be connections provided for receiving external alarm reset and silencing switches.

C. The system shall provide a remote malfunction indication. If the signal from any sensor goes 5% below zero or 5% above full scale, signal is lost, the control module malfuctions or is removed, or if the system loses power, the trouble relay will indicate a trouble condition.

D. The gas monitoring system shall be operable at ambient temperatures from -10^o C to 50^o C and over a humidity range of 5% to 95% relative humidity, non-condensing.

E. Power requirement for the controller shall be 120 VAC, 60 Hz.

F. Controller shall be supplied with optional battery backup for operation during short duration power outages.

G. With the exception of periodic check and recalibrations as recommended by the manufacturer, no periodic maintenance shall be necessary. Gas monitoring systems shall be GasGuard XL with Ultima XA sensors/transmitters as manufactured by MSA Instruments or approved equal.

PART 3 – EXECUTION

3.01 REQUIREMENTS

A. Refer to Section 40 70 00 – Instrumentation for Process Systems.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 40 78 00
PANEL MOUNTED INSTRUMENTS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, test, install and place in satisfactory operation the panel mounted instruments, with all spare parts, accessories, and appurtenances as specified herein and as shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 40 61 13 – Process Control System General Requirements

B. Section 40 61 22 – Tools, Supplies, and Spare Parts, General

C. Section 40 67 00 – Control System Equipment Panels and Racks

1.03 GENERAL INFORMATION AND DESCRIPTION

A. All equipment mounted on the face of a panel shall conform to the same NEMA rating specified for the panel construction.

1.04 TOOLS, SUPPLIES AND SPARE PARTS

A. Tools, supplies and spare parts shall be provided as specified in Section 40 61 22 – Tools, Supplies, and Spare Parts, General. In addition, the following specific spare parts items shall be provided:

1. One of each type of panel mounted equipment (i.e., indicators, signal converters, etc.) provided under this Contract.

2. Five of each type of interposing control relay provided under this Contract.

PART 2 – PRODUCTS

2.01 OPERATORS

A. Control operators shall be 30.5 mm, round, heavy-duty, oil tight NEMA 4X corrosion resistant. For Hazardous areas, control operators shall be rated NEMA 7.

B. Pushbuttons shall be non-illuminated, spring release type. Pushbuttons shall include a full guard. Panic stop/alarm pushbuttons shall be red mushroom type with manual-pull release. Selector switches shall be non-illuminated, maintained contact type, unless otherwise indicated.

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C. Pilot lights shall be of the proper control voltage, push-to-test LED type with lens and LED lamp colors as specified below.

1. Red: stopped, off, or closed

2. Green: running, on, or opened

3. Amber: fault, alarm, or warning

4. White: generic non-alarm status

5. Blue: control power on

D. Control operators shall have legend plates as specified herein, indicated on the Drawings, or otherwise directed by the Engineer. Legend plates shall be plastic, black field (background) with white lettering. Engraved nameplates shall be securely fastened above each control operator. If adequate space is not available, the nameplate shall be mounted below the operator.

E. Control operators for all equipment under this Contract shall be of the same type and manufacturer unless otherwise indicated. Control operators such as pushbuttons (PB), selector switches (SS), and pilot lights (PL) shall be Cutler-Hammer/Westinghouse Type E34, Square D Company Type SK, or approved equal.

2.02 ELECTRONIC INDICATORS

A. Electronic indicators shall be 3.5 or 6 digit, as appropriate, with 0.56" high red LED display. Indicators shall be provided with nameplate and scale calibrated to match the calibration of the primary element. The unit shall be designed primarily for use with 4-20 mA current loop signal circuits. Indicator operating voltage shall be 115 VAC 10%, 60 Hz. Indicator controls shall include three (3) front-panel pushbuttons for modifying alarm values and other indicator setup. Two (2) form-C relays shall be provided for each indicator. Relay contact outputs shall be rated 5A, 120/240 VAC, resistive load. Where required, a regulated and isolated 24 V excitation power supply shall be provided. Indicators shall be suitable for indoor or outdoor service as required and shall have the same NEMA enclosure rating as the associated enclosure.

B. Indicators shall be Red Lion Model IMP or APLCL, Precision Digital, or approved equal.

2.03 RELAYS

A. Interposing control relays (CR)

1. Where required to interface between motor control centers, equipment controls, and control panels, interposing relays and associated control wiring circuitry shall be furnished and installed to provide the monitoring and/or control functions specified herein.

2. Interposing relays shall be small format type, DPDT, minimum 10 amp, 120 VAC contact rating.

3. Relay coils shall be 120 VAC or 24 VDC as required to interface with equipment.

4. Relays shall have a flag indicator to show relay status, a pushbutton to allow manual operation of the relay, and an internal pilot light to indicate power to the coil.

5. Relays shall be as manufactured by Square D, Potter & Brumfield, Allen-Bradley, or approved equal.

B. Timing Relays (TR)

1. Timing relays shall be electronic type with 120 VAC coils unless otherwise specified or indicated on the Drawings. Timers shall be provided with a minimum of two SPDT timed output contacts and instantaneous contacts where required. Contact ratings shall be the same as for interposing relays.

2. Timing relays shall be the general purpose plug-in type, Type JCK as manufactured by Square D Company, equivalent by Eaton/Cutler-Hammer, equivalent by Allen-Bradley, or approved equal.

PART 3 – EXECUTION

3.01 REQUIREMENTS

A. Refer to Section 40 67 00 – Control System Equipment Panels and Racks, for additional requirements.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 40 78 56

ISOLATORS, INTRINSICALLY SAFE BARRIERS, AND SURGE SUPPRESSORS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, install, and place in satisfactory operation the isolators, intrinsically safe barriers, and surge protection devices (SPDs) as specified herein and as shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 40 61 13 – Process Control System General Requirements

B. Section 40 61 22 – Tools, Supplies, and Spare Parts, General

C. Section 40 67 00 – Control System Equipment Panels and Racks

D. Section 40 78 00 – Panel Mounted Instruments

1.03 TOOLS, SUPPLIES AND SPARE PARTS

A. Tools, supplies and spare parts shall be provided as specified in Section 40 61 22 – Tools, Supplies, and Spare Parts, General.

B. In addition, the following specific spare parts items shall be provided:

1. Five of each type of surge protection device provided under this Contract.

PART 2 – PRODUCTS

2.01 SURGE PROTECTION

A. General

1. All electrical and electronic elements shall be protected against damage due to electrical transients induced in interconnecting lines from lightning discharges and nearby electrical systems.

2. Manufacturer's Requirements: All surge protection devices shall be manufactured by a company that has been engaged in the design, development, and manufacture of such devices for at least 5 years. Acceptable manufacturers shall be Phoenix Contact, Edco, Transtector, Weidmuller, or approved equal.

3. Surge protection device installations shall comply with UL 94, the National Electric Code (NEC), and all applicable local codes.

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4. Surge protection devices shall be installed as close to the equipment to be protected as practically possible.

5. Device Locations: As a minimum, provide surge protection devices at the following locations:

   a. At connections between AC power and electrical/electronic equipment, including, but not limited to, panels, assemblies, and field mounted analog transmitters.

   b. At both ends of signal circuits that have any portion of the circuit extending outside of a building.

B. AC power protection

1. Surge protection device assemblies for connections to AC power supply circuits shall:

   a. Be provided with two 3-terminal barrier terminal strips capable of accepting No. 12 AWG solids or stranded copper wire. One terminal strip shall be located on each end of the unit.

   b. Have a nonflammable enclosure that meets or exceeds UL 94 V0 flammability requirements. The surge protection device shall be provided with provisions for mounting to interior of equipment racks, cabinets, or to the exterior of freestanding equipment.

   c. Be constructed as multistage devices consisting of gas tube arrestors, high energy metal oxide varistors, or silicon avalanche suppression diodes. Assemblies shall automatically recover from surge events and shall have status indication lights.

   d. Comply with all requirements of UL 1449, latest edition.

   e. Be able to withstand a peak surge current of 10,000 amps based on a test surge waveform with an 8-microsecond rise time and a 20-microsecond exponential decay time, as defined in UL 1449.

   f. Have the following characteristics:

      1) Maximum Continuous Operating Voltage: 150VAC

      2) Maximum Operating Current: 20 amps

      3) Ambient Temperature Range: -20 degrees C to +65 degrees C

      4) Response Time: 5 nanoseconds

C. Analog signal circuit protection

1. Surge protection device assemblies for analog signal circuits shall:

a. Have four lead devices with DIN Rail mounting.

b. Have a nonflammable enclosure that meets or exceeds UL 94 V0 flammability requirements.

c. Be constructed as multistage devices consisting of gas tube arrestors and silicon avalanche suppression diodes. Gas tube arrestors and diodes shall be separated by a series impedance of no more than 20 ohms. Assemblies shall automatically recover from surge events.

d. Comply with all requirements of UL 497B.

e. Be able to withstand a peak surge current of 10,000 amps based on a test surge waveform with an 8-microsecond rise time and a 20-microsecond exponential decay time, as defined in UL 1449.

f. Limit line-to-line voltage to 40 volts on 24VDC circuits.

g. Have the following characteristics:

1) Maximum Continuous Operating Voltage: 28VDC

2) Ambient Temperature Range: -20 degrees C to +65 degrees C

3) Response Time (Line-to-Line): 5 ns

2.02 INTRINSICALLY SAFE BARRIERS AND RELAYS

A. Intrinsically safe relays and barriers shall be provided where required to interface with equipment located in Classified (i.e., hazardous) areas.

B. Intrinsically safe relays and barriers shall be FM approved.

C. Manufacturer shall be

1. Pepperl+Fuchs

2. Crouse Hinds

3. Square D

4. Or approved equal.

2.03 ISOLATORS AND CONVERTERS

A. Signal converters shall be provided as required to provide control functions and to interface instrumentation and controls, equipment panels, motor control centers and other instrumentation and controls supplied under other Specification Divisions to the controls provided herein.

B. General Requirements

1. Converters shall be of the miniature type, utilizing all solid-state circuitry suitable for mounting within new or existing cabinetry. Where sufficient cabinet space is not available, sub panels or supplemental enclosures shall be provided.

2. Power supply shall be 120V, 60 hertz where required by the converter, unless otherwise indicated.

3. Repeatability shall be 0.1% of span, deadband shall be 0.1% span, maximum.

4. Where specific converters are not listed but are required to interface with the process control system, they shall comply with the general requirements stated herein.

C. Current to Current (I/I) Isolators

1. Current to current isolators shall be furnished where necessary to provide an isolated current loop, calculations or signal amplification between the plant process control system and instrumentation and control loops. Isolators shall be sized such that resistance of existing loops shall not exceed maximum rated resistance.

2. Isolators shall be as manufactured by AGM, Moore Industries, Rochester Instrument Systems (RIS), Phoenix Contact, Weidmuller, Acromag, or approved equal.

D. Electronic Switches (Alarm Relays)

1. Electronic switches shall be furnished with a calibrated dial for adjusting set points. The input to the switch shall be 4 - 20 mA DC, and the set point shall be adjustable over the full range. Unless otherwise noted, the dead band shall be fixed at less than 2% of span. The set point stability shall be +0.1% per degree F. The repeatability shall be +0.1% of span. The units shall be furnished with SPDT relays rated at 10 amperes at 115 VAC.

2. Electronic switches shall be as manufactured by AGM, Moore Industries, Rochester Instrument Systems (RIS), Phoenix Contact, Weidmuller, Acromag, or approved equal.

E. RTD to Current Signal Converters

1. RTD to current signal converters shall convert a 3-wire RTD input signal to an isolated 4 20 mADC output signal. Accuracy shall be 0.10% of span or better. Calibrated span of each converter shall be as indicated on the instrument list. The Contractor shall coordinate calibration of the signal converters with existing RTD elements.

2. Signal converters shall be as manufactured by AGM, Moore Industries, Rochester Instrument Systems (RIS), Phoenix Contact, Weidmuller, Acromag, or approved equal.

PART 3 – EXECUTION

3.01 REQUIREMENTS

A. See Section 40 78 00 – Panel Mounted Instruments for additional requirements.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 40 79 00

MISCELLANEOUS INSTRUMENTS, VALVES, AND FITTINGS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, test, install and place in satisfactory operation the instrumentation and control system accessories with all spare parts, and appurtenances as herein specified and as shown on the Drawings.

B. Accessories include various items of equipment that may be required in the system but are not scheduled. Accessories are shown on details, flow sheets or plans. Accessories are also called out in Section for scheduled instruments and in the installation Sections. It is not intended, however, that each piece of hardware required will be specifically described herein. This Section shall be used as a guide to qualify requirements for miscellaneous hardware whether the specific item is described or not.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 40 61 13 – Process Control System General Provisions

B. Section 40 61 15 – Process Control System Submittals

C. Section 40 61 91 – Process Control System Instrument List

D. Section 40 70 00 – Instrumentation for Process Systems

1.03 SUBMITTALS

A. Per Section 40 61 15 – Process Control System Submittals

B. Impulse piping layout and routing drawings

C. Complete instrument assembly drawings showing orientation to installed process piping.

PART 2 – PRODUCTS

2.01 PROCESS TUBING

A. Process, impulse, or capillary tubing shall be 1/2 x 0.065-inch seamless, annealed, ASTM A-269 Type 316L stainless steel with 37 degrees Type 316 stainless steel flared fittings or Swagelock or Parker-CPI flareless fittings.

B. Piping for closely coupling instruments to process seals shall be standard stainless-steel NPT threaded piping or NPT tapped mounting blocks.

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C. A nickel-based lubricant shall be used on threaded stainless steel piping connections to prevent galling.

2.02 POWER, CONTROL, AND SIGNAL CABLES

A. Power, control and signal wiring shall be provided under Division 26 of the Specifications, unless otherwise indicated.

2.03 CHEMICAL DIAPHRAGM SEALS

A. Diaphragm seals shall be provided for isolation of pressure gauges, switches and transmitters attached to systems containing chemical solutions or corrosive fluids. As a minimum, seals shall be of all 316 stainless steel construction. In general, diaphragms shall be 316L stainless steel for operating pressures at or above 15 psi and elastomers for operating pressures below 15 psi. However, all components shall be non-reactive with the process fluid in all cases.

1. Refer to Section 40 61 91 – Process Control System Instrument List for specific materials requirements.

B. Seal shall have fill connection, 1/4-inch NPT valved flush port and capable of disassembly without loss of filler fluid. Where specified, diaphragm seals shall comply with the above requirements and shall be provided with 316 SS factory filled capillaries.

C. Seals shall be Helicoid Type 100 HA, Mansfield & Green, Ashcroft, or approved equal.

2.04 TAMPER EVIDENT PAINT

A. Piping and screwed/bolted connections of instrumentation containing the filling medium shall be marked with a small continuous tick mark of tamper evident paint over each piping/instrument joint. Tamper evident paint shall be applied prior to instrument assemblies arriving on the job site. Disturbance of the joint shall break the paint.

B. Instrument assemblies with broken paint or missing paint shall not be accepted and shall be repaired or replaced at no additional cost to Owner. Paint shall be Dykem Cross-Check or approved equal.

2.05 ISOLATION VALVES

A. Isolation valves shall be 1/2-inch diameter ball valves, unless otherwise indicated, with a Type 316 stainless steel body, Type 316 stainless steel ball. Where 316 stainless steel is not compatible with the process fluid, materials of construction shall be suitable for the associated process fluid (e.g., PVC for chemical service).

2.06 ALARM ANNUNCIATION DEVICE

A. Sirens:

1. For Class I, Division 2 areas and non-hazardous areas:

    a. Provide NEMA 4X and Class I, Division 2 rated alarm horn capable of 32 selectable warning tones. Coordinate tone selection with Owner. Volume shall be field adjustable between 0 and 114 dBA measured at 10 feet.

    b. Alarm horn shall be the SelecTone 302GCX series with UTM tone module as manufactured by Federal Signal Corporation or approved equal.

2. For Class I, Division 1 areas:

    a. Provide NEMA 4X and Class I, Division 1 rated alarm horn capable of 32 selectable warning tones. Coordinate tone selection with Owner. Volume shall be field adjustable between 0 and 114 dBA measured at 10 feet.

    b. Alarm horn shall be the SelecTone 302X series with UTM tone module as manufactured by Federal Signal Corporation or approved equal.

B. Strobe Lights:

1. Strobes located within the same room, or otherwise visible from any shared frame of view, shall be synchronized per the requirements of NFPA 72. Strobes shall by synchronized by the strobe manufacturer’s synchronization module. Strobe circuits shall not exceed the continuous duty current rating of the synchronization module. Synchronization module shall be Federal Signal Model SSM, Edwards Signaling Model EG1M-RM, or approved equal.

2. For Class I, Division 2 areas and non-hazardous areas:

    a. Provide red strobe status indicator. Unit shall be rated NEMA 4X and Factory Mutual approved for a Class I, Division 2, Group D area. Unit shall contain a durable polycarbonate housing and be surface mount. Unit shall be UL listed. Strobe shall be powered from 24VDC.

    b. Alarm strobe shall be Federal Signal Model 225XST, Edwards Signaling Model 116DEGEX-FJ, or approved equal.

3. For Class I, Division 1 areas:

    a. Provide red explosion-proof dome covered strobe unit rated NEMA 4X and Factory Mutual certified for a Class I, Division 1, Group D area. Unit shall be UL listed. Strobe shall be powered from 24VDC.

b. Alarm strobe shall be Federal Signal Model 27XST, Edwards Signaling Model 116DEGEX-FJ, or approved equal. Compatible mounting hardware by the strobe manufacturer shall be furnished.

4. Lens color shall be as indicated on the Drawings.

PART 3 – EXECUTION

3.01 REQUIREMENTS

A. Refer to Section 40 70 00 – Instrumentation for Process Systems.

END OF SECTION

SECTION 41 22 00
CRANES AND HOISTS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, install, and make fully operational the crane and hoist systems in the locations and conditions of service, as shown on the Drawings and as specified in the Crane and Hoist Schedule.

B. Equipment shall be provided in accordance with the requirements of Section 46 00 00 – Equipment General Provisions.

C. All equipment supplied under this Specification shall comply in all respects with the provisions of the Occupational Safety and Health Act of 1970, including all standards promulgated under the authority of such Act, and shall also meet all applicable industrial codes in the New York State.

D. The manufacturer and ultimately the Contractor shall be totally responsible for structural design of the crane and hoist systems, for the compatibility of all equipment, and for verification of required operating clearances.

E. All parts of the mechanism furnished shall be amply designed and constructed for the maximum stresses occurring during fabrication, erection, and continuous operation. All equipment specified herein shall be designed for the Crane Manufacturer's Association of America Duty Classification as specified herein.

F. If the Contractor elects to utilize the crane and hoist equipment in any way during the erection of piping and installation of equipment, the Contractor shall notify the Owner in writing and shall provide for an inspection by the equipment manufacturer and take any steps necessary to return the equipment to "as new" condition. The Contractor shall also obtain recertification by the manufacturer and reinstate all warranties and guarantees.

G. Related Sections:

1. Division 05 – Metals

2. Section 09 90 00 – Painting

3. Section 46 00 00 – Equipment General Provisions

1.02 CAPACITY AND DESIGN LOADS

A. All design loads shall meet CMAA requirements. The design load for stress calculations and deflection shall be based upon the requirements of CMAA and include Vertical Inertia Forces (VIF), Deal Load Factor (DLF), Hoist Load Factor (HLF), and Inertia

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Forces from Drives (IFD). Operating Wind Load shall be in accordance with the Governing Building Code on areas exposed to wind.

B. The rated load capacity of each crane shall be clearly labeled on each crane using a label size easily read from the floor level and/or loading position.

1.03 CRANE AND HOIST SCHEDULE

Location	Mechanical Screen Room	Mechanical Screen Room	Mechanical Screen Room	Compactor Room
General				
Quantity	1	1	1	2
Indoor / Outdoor	Indoor	Indoor	Indoor	Indoor
Capacity, lbs (tons)	1,000 (0.5)	350 (0.2), minimum	1,000 (0.5)	1,000 (0.5)
Winch Capacity, tons	N/A	1/2	1/2	N/A
Operating Floor Elevation	70.5	70.5	70.5	70.5
Area Classification	Class 1. Division 1, Group D	Class 1. Division 1, Group D	Class 1. Division 1, Group D	Class 1. Division 1, Group D
Crane				
Crane Type	Monorail	Davit Arm Assembly (Fall Protection)	Davit Crane (Equipment)	Fixed
Material of Construction	Steel	Aluminum	Stainless Steel	N/A
Configuration	Underhung	Wall Mounted	Flush Mounted & Wall Mounted	Hook Mounted
Working Span, ft	See Contract Drawings	N/A	N/A	N/A
Trolley Hoist				
Trolley Type	Hand Geared	N/A	N/A	N/A
Hoist Type	Manual	Manual	Manual	Manual
ASME Duty Classification	Class H1	Class H1	Class H1	Class H1
Hook Elevation				
High Point Elevation	85.0	70.50	70.50	85.0
Low Point Elevation	70.5	52.5	52.5	70.5
Hook Reach, inches	N/A	24-42	24-66	N/A
Maximum Headroom, in	12	N/A	N/A	12

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1.04 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of other requirements of the Specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced

Specifications, codes and standards refer to the most current issue available at the time of the Bid.

1. CMAA – Crane Manufacturers Association of America
2. AISC – “Manual of Steel Construction”
3. ASME B30.2 – Overhead and Gantry Cranes
4. ASTM A48 – Standard Specifications for Gray Iron Castings
5. ANSI B30.11 – Safety Code for Underhung Cranes and Monorail Systems
6. ANSI B30.16 – Safety Code for Overhead Hoists
7. ANSI Z359.1 – Safety Requirements for Personal Fall Arrest Systems, Sub systems and Components
8. MMA MH27.1 – Monorail Manufacturers Association
9. OSHA 1910 140 – Personal Protective Equipment
10. OSHA 1910.179 – Overhead and Gantry Cranes
11. OSHA 1926.502 – Fall Protection

1.05 SUBMITTALS

A. The following items shall be submitted in accordance with, or in addition to the submittal requirements specified in Section 01 33 00 – Submittal Procedures and Section 46 00 00 – Equipment General Provisions:

1. Shop Drawings
2. O&M Manuals
3. Certification that the systems have been designed to resist all loads implied herein and loadings stipulated in the applicable building codes of New York State. The Certification shall also state that the design has been performed and signed and sealed by a Professional Engineer registered in New York State.

B. Certification that the equipment has been field tested and passed.

C. Details and design calculations shall be submitted, signed, and sealed by a Professional Engineer registered in New York State for any of the following components furnished by the Manufacturer:

1. Runway beams.

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2. End stops and connections.

D. Complete layout drawings of entire trolley hoist system verifying entire access envelope of system, both vertically and horizontally at all levels of travel access including floor plans, equipment locations, access doors, etc. Hook extents including maximum and minimum elevations and all clearances shall be defined on drawings for proposed system.

1.06 WARRANTY AND GUARANTEE

A. Warranty and Guarantee shall be as specified in Section 46 00 00 – Equipment General Provisions with the exception that the warranty period shall be for two (2) years.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Trolley Hoists and Manual Hoists shall be manufactured by the following:

1. ACCO Industries,
2. Yale Hoists,
3. Harrington Hoists,
4. CM Cyclone Hoists,
5. Chester Hoists,
6. Or approved equal.

B. Davit Arm assembly (fall protection) shall be manufactured by the following:

1. 3M Corp.,
2. Honeywell,
3. Or approved equal.

C. Davit Crane (Equipment) shall be manufactured by the following:

1. Thern Winches and Cranes,
2. Or approved equal.

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2.02 GENERAL

A. All crane components shall be new and come from reputable brands having domestic operations in existence for a minimum of 10 years.

B. All crane components will have properly finished ends and surfaces. Structural sections shall be saw cut producing clean ends dressed to eliminate sharp edges. Torch cuts with uneven edges will not be acceptable. Surfaces must be free of mill scale, rust, and debris properly prepared prior to coating.

C. Welding shall follow the current recommended practices of the AWS (American Welding Society) D14.1 specifications.

D. Moving members of the crane shall be separated by a clearance of at least 3 inches vertically from any overhead obstruction, and 2 inches horizontally from any lateral obstruction.

2.03 TROLLEY / HOISTS

A. Trolleys:

1. Manual trolleys shall be of hand-driven gear type.

2. Manual trolleys shall be spark resistant and designed for explosive environments with all load carrying parts constructed of steel, rubber end stops, and bronze trolley wheels.

3. The rated capacity of trolley hoists shall be painted black with stencil on the trolley hoist.

B. Manual Hoists:

1. Manual hoists shall be spark resistant and designed for explosive environments with copper-coated suspension and load hooks, stainless steel load chain and hand chain.

2. Wheels and axles shall be equipped with anti-friction bearings which are permanently sealed and lubricated. The gear shaft shall have precision, oil lubricated ball bearings.

3. The hoist drive shall be single reeved type and shall include a geared trim with inherent or mechanical load brake, hook, hand chain.

4. The hoist frame shall be oil tight, of steel construction with no part of the load carried by assembly bolts. The gearing shall be machine cut and heat treated and shall operate in an oil bath.

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2.04 DAVIT ARM ASSEMBLY (FALL PROTECTION)

A. General:

1. Davit arm assembly shall be installed to provide a secure fall arrest anchor point and retrieval when entering the screen channels from the operating floor.

2. Design requirements shall be as specified in the schedule located in Article 1.03 of this Section.

B. Davit Arm:

1. The davit arm shall be equipped with a geared winch that provides lowering and raising capabilities with braking systems enclosed in a sealed housing.

2. Provide self-retracting lifeline (SRL) with built-in emergency retrieval winch.

3. Winch and SRL shall be as recommended by davit arm assembly manufacturer.

4. The davit arm shall have quick release mounting brackets for winch and SRL.

5. Provide fall arrest anchorage point rated to 5,000 lbs.

6. The mast of the davit arm shall be adjustable and capable of a 36-inch offset. The davit arm assembly shall be portable allowing it to be moved from one channel to another.

C. Winches:

1. The geared winch with a minimum lifting capacity of 350 lbs. The SRL shall have a minimum weight capacity of 310 lbs. Winch and SRL shall have a minimum of 30 ft long stainless steel cable.

2. Winch shall be located such that they may be operated above and behind the guardrail installed around the screen channel opening. The mast shall be tall enough so that the top of the mast arm is at least 60-inches above the finished floor elevation.

3. The SRL shall stop falls within 2-feet, have a shock absorption capability to minimize injuries and allow personnel to raise or lower loads at an average speed of 10 to 30 feet per minute in an emergency.

D. Davit Base:

1. A fixed, side mounted, stainless steel base shall be provided for each channel.

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2. The side mounted base shall be located as indicated on the Contract Drawings and shall be suitable for installation in existing concrete. Anchors shall be designed and installed by the Contractor.

3. Davit base shall be provided with base cap with lanyard to keep water and debris out when the crane is removed.

E. Davit arm and winches shall be furnished in separate carrying bags.

F. All equipment described herein shall meet the federal and state occupational safety and hazard standards and consensus standards (ANSI) for fall protection and material handling.

G. The Davit Arm Assembly shall be labeled with a stainless steel identification plate.

1. Identification plate shall include essential information, including but not limited to:

a. Manufacturer's Name

b. Model number and Serial #

c. Capacity rating at each position.

2.05 DAVIT CRANE (EQUIPMENT)

A. General:

1. The Davit Crane shall be provided to lower and retrieve materials and tools from the screen channels.

2. Design requirements for the Davit Crane shall be as specified in the Schedule located in Article 1.03 of this Section.

B. Davit crane shall be Type 316 stainless steel construction.

C. The equipment davit crane shall be portable and shall have a minimum lifting capacity of 1,000 lbs at the shortest hook reach and 500 lbs at the furthest hook reach.

1. The equipment davit crane shall be compatible with either pedestal type davit base or wall type davit base.

D. The hook shall be adjustable and shall meet the range as specified in Article 1.03 of this Section.

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E. The minimum height of the boom shall be 50-inches above the operating floor. Base extension shall be provided to meet the minimum height requirement.

F. Davit Base:

1. Provide flush bases and wheel bases as shown on the Contract Drawings.

2. The Davit Base shall be Type 316 stainless steel construction. Anchors shall be designed and installed by the Contractor.

3. The Davit Base shall have a roller bearing to allow for ease of rotation when under load.

4. Davit Base shall be provided with base cap with lanyard to keep water and debris out when the crane is removed.

G. Manual Winch:

1. Provide One (1) Type 316 stainless steel spur gear manual winch shall be provided with the equipment davit crane.

2. The winch shall be provided with a ¼ inch Type 316 stainless steel wire rope with swivel hook.

H. The Equipment Davit Crane shall be labeled with a stainless steel identification plate.

1. Identification plate shall include essential information, including but not limited to:

a. Manufacturer's Name

b. Model number and Serial #

c. Capacity rating at each position

I. All hardware, including anchor bolts, nuts, and washers shall be type 316 stainless steel.

PART 3 – EXECUTION

3.01 MANUFACTURER'S FIELD SERVICES

A. The services: of a qualified manufacturer's technical representative shall be provided in accordance with Section 46 00 00 – Equipment General Provisions and shall include the following site visits for each crane and hoist system

Service	Number of Trips	Number of Days/Trip
Installation and Testing	1	1
Startup and Training	1	1
Services after Startup	1	1

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3.02 INSTALLATION

A. All crane equipment shall be installed in accordance with the applicable Sections of Division 05 – Metals, and the manufacturer's instructions and recommendations.

3.03 FIELD TESTS

A. Field tests shall be conducted in accordance with Section 46 00 00 – Equipment General Provisions and the manufacturer's instructions and recommendations. Prior to initial use, all cranes shall be proof-tested at 125% of their rated load in accordance with all OSHA requirements.

3.04 PAINTING

A. The crane shall be painted ANSI safety yellow before shipment. Painting shall be in accordance with Section 09 90 00 – Painting.

B. A wire-brushing and/or solvent wipe shall be performed prior to painting to clean and remove debris, mill scale, dirt, and oils.

C. At least one quart of matching color paint shall be shipped with each crane for field touch-ups.

D. The crane shall be properly banded and skidded prior to shipment. Any paint damage, scratches, blemishes to the finish of the crane, caused by shipping, transportation via common carrier, etc., shall be repaired by the Contractor.

E. Rated capacity of crane system shall be painted with stencil in black on all components of crane system as specified herein.

END OF SECTION

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SECTION 41 70 01
PORTABLE MAINTENANCE PLATFORM

PART 1 – GENERAL

1.01 SUMMARY

A. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required, to furnish portable stainless steel maintenance platform completed with all accessories.

1.02 REFERENCES

A. ASTM A276 - Stainless and Heat-Resisting Steel Bars and Shapes.

B. ASTM A666 - Austenitic Stainless Steel, Sheet, Strip, Plate and Flat Bar.

1.03 QUALITY ASSURANCE

A. The following provisions shall pertain to Work under this Section:

1. Manufacturer's Qualifications:

a. The Contractor shall provide evidence to the Engineer that the manufacturer has a minimum of five (5) years' experience in the design, manufacture, and supervision of installation of equipment of the type required under this Section.

B. The manufacturer shall provide a Certificate of Conformance (CoC) prior to shipping.

1.04 SUBMITTALS

A. All submittals shall be in accordance with the procedures and requirements set forth in the Contract Documents and Section 01 33 00 – Submittal Procedures and shall include but not be limited to the following:

1. Product data sheets indicating parts list with materials of construction and other details related to the fabrication and construction of portable maintenance platform.

2. Dimensional drawings of the portable maintenance platform showing platform configuration, dimensions, weight, capacity, and other pertinent details.

1.05 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall deliver, store, and handle the equipment and materials provided under this Section as specified in Section 01 65 00 – Product Delivery Requirements and Section 01 66 00 – Protection of Materials and Equipment.

1.06 SPARE PARTS, SPECIAL TOOLS, AND SUPPLIES

A. All spare parts shall be of the same material and quality as specified in this Section. The Contractor shall provide the following spare parts:

1. Four (4) casters for each maintenance platform.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Erect-A-Step, Andrews SC.

B. Or approved equal.

2.02 MATERIALS / EQUIPMENT

A. General:

1. Contractor shall furnish portable maintenance platforms as shown on the Drawings.

2. Portable maintenance platform shall include frame, platform, stair unit, removable handrail, swivel casters, supports, and hardware.

3. Maintenance platform shall be designed to comply with OSHA and ANSI regulations. The platform shall be rated for a 300 lbs capacity and meet the OSHA required safety factor of four (4).

4. Maintenance platform shall be portable and shall be made from all new material and fabricated to be clean, free of burrs or sharp edges.

5. Maintenance platform shall be highly mobile and easy to position in tight spaces.

B. Construction:

1. Frame: The platform and ladder frame shall be fabricated from mill finished Type 316 stainless steel square tube.

2. Ladder tread: Ladder treads shall be Type 304 stainless steel construction. Ladder tread shall be non-slip, serrated surface. Treads shall be seven (7) inches deep and twenty-four (24) inch wide.

3. Platform:

   a. Top walking platform shall be Type 304 stainless steel construction with non-slip, serrated surface.

   b. Top platform shall be sixty (60) inches tall and shall be twenty-four (24) inches wide and thirty-six (36) inches long.

   c. The platform shall be provided with four (4) inches high toe board on all railed platform sides. Toe board shall be fabricated from mill finished Type 316 stainless steel.

4. Handrail:

   a. Handrail shall be designed to resist loads and designed requirements in accordance with OSHA 1910 Subpart D Walking-Working Surface.

   b. Handrail shall be forty-two (42) inches high with midrail.

5. Casters:

   a. Caster shall be 316 stainless steel rigid casters with polyurethane wheels.

   b. Caster shall have sealed precision ball bearings design suitable for dirty and dusty environments.

   c. Maintenance platform shall be furnished with caster brakes or non-skid rubber foot caps to prevent platform from moving during use.

6. Hardware: All hardware shall be Type 316 stainless steel.

C. The platform shall include labels listing the model number, rated load capacity, and any applicable safety instructions and signs.

2.03 FABRICATION / ASSEMBLING / FINISHES

A. The platform shall be fabricated to comply with all applicable OSHA and ANSI standards.

B. The platform shall be continuously welded to the fullest extent possible. Weld discoloration shall be removed via manual or chemical cleaning. The platform

shall be delivered in the as-built mill finished condition without further polishing or finishing processes.

C. All components shall be provided with coating system in accordance with the recommendation of the Manufacturer except stainless steel and plastic components.

2.04 SOURCE QUALITY CONTROL / SHOP TESTS

A. The platform shall be visually inspected for any deformation prior for shipment.

PART 3 – EXECUTION

3.01 EXAMINATION / PREPARATION

A. The Contractor shall visually inspect the platform for any deformation.

3.02 INSTALLATION

A. The Contractor shall provide fully assembled portable maintenance platform.

END OF SECTION

SECTION 46 00 00
EQUIPMENT GENERAL PROVISIONS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, install, test, and place in acceptable operation all mechanical equipment and all accessories as specified, as shown on the Drawings, and as required for a complete and operable system.

B. The mechanical equipment shall be provided complete with all accessories, special tools, spare parts, mountings, shims, sheaves, couplings, and other appurtenances as specified, and as may be required for a complete and operating installation.

C. The Contractor shall provide the Owner with complete and operational equipment/systems. To this end, it is the responsibility of the Contractor to coordinate all interfaces related mechanical, structural, electrical, instrumentation, and control work and to provide necessary ancillary items such as controls, wiring, etc., to make each piece of equipment operational as shown and specified.

D. The complete installation shall be free from excessive vibration, cavitation, noise, and oil or water leaks.

E. Comply with reference specifications, codes and standards as specifically modified, complimented, and supplemented herein.

F. The requirements of this Section shall apply to equipment furnished under Divisions 40, 41, and 46.

G. Related Sections:

1. Section 03 60 00 – Grout
2. Section 05 05 13 – Galvanizing.
3. Section 05 05 23 – Metal Fastening
4. Section 05 10 00 – Metal Materials
5. Section 05 12 00 – Structural Steel
6. Section 09 90 00 – Painting
7. Section 26 05 00 – Basic Electrical Requirements
8. Section 26 05 60 – Low-Voltage Electric Motors

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1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. All equipment, materials, and installations shall conform to the requirements of the most recent editions with latest revisions, supplements, and amendments of the Specifications, codes, and standards listed in Section 01 42 00 – References along with those identified herein this and other individual Specification Sections.

B. American Institute for Steel Construction (AISC)

C. American National Standards Institute/American Bearing Manufacturers Association (ANSI/ABMA):

1. ANSI/ABMA 9 – Load Ratings and Fatigue Life for Ball Bearings

2. ANSI/ABMA 11 – Load Ratings and Fatigue Life for Ball Bearings

D. Acoustical Society of America (ASA) / American National Standard Institute (ANSI) S2.75, Shaft Alignment Methodology:

1. Part 1: General Principles, Methods, Practices, and Tolerances

2. Part 2: Vocabulary

3. Part 3: Alignment of Vertically Oriented Rotating Machinery

4. Guidelines and recommendations included in ASA/ANSI S2.75 shall establish and be interpreted as the minimum requirements for acceptance for leveling, grouting and alignment related work.

E. American National Standards Institute / American Society of Mechanical Engineers (ANSI/ASME) Standard B29.1, Heavy Duty Offset Sidebar Transmission Roller Chains and Sprocket Teeth.

F. American Welding Society (AWS):

1. D1.1 "Structural Welding Code - Steel"

2. D1.2 "Structural Welding Code - Aluminum" of the American Welding Society

3. D1.6 “Structural Welding Code – Stainless Steel”

G. Electrical Apparatus Service Association, Inc. (EASA) Mechanical Reference Handbook (latest revision).

H. Standard, ISO 1940 – Mechanical Vibration – Balance quality requirements for rotors balance quality grade for rotors in a constant rigid state.

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I. In the event of conflict between individual Specifications and reference specifications, codes and standards, the more restrictive criteria shall govern.

1.03 ACTION/INFORMATIONAL SUBMITTALS

A. Product Data:

1. Comply with Section 01 33 00 – Submittals Procedures

2. Fabrication information

B. Provide submittals identified in individual equipment Specification Sections in addition to the submittals identified herein.

C. Shop Drawings shall include the following information in addition to the requirements of Section 01 33 00 – Submittal Procedures and shall include the following additional information:

1. Equipment name, identification number and Specification number.

2. Performance characteristics and descriptive data, including but not limited to capacity, power, speed, torque, and efficiency.

3. Detailed equipment dimensional drawings and setting plans including but not limited to:

a. General cutaway sections

b. Materials of construction

c. Dimension of shaft projections

d. Shaft and keyway dimensions

e. Shaft diameter

f. Shaft connection details

g. Dimension between bearings

h. General dimensions of equipment

i. Anchor bolt locations

j. Forces

k. Assembly views

l. Weights: Provide weight of entire equipment assembly, including motor and base weight of individual major subassemblies. Indicate the weight of each component, and total static and dynamic loads imparted by the equipment to the supporting structure.

m. Rotating assembly technical information and illustration.

n. Drawings shall identify each component by tag number to which the catalog data and detail sheets pertain.

o. Drawings showing the location and type of all equipment, system components, supports, hangers, foundations, and the required clearances to operate and maintain equipment, valves, and system components in a code compliant, safe, and ergonomic manner. Drawings shall show clearances reserved for walking access around all sides, for opening access doors fully, for visual inspection for condition monitoring, and for the performance of maintenance tasks including but not limited to changing filters, replacing belts, maintaining lubrication levels, predictive maintenance and performing diagnostic functions.

4. Drive and motor data as required by Division 26 – Electrical. Complete motor data shall include but not be limited to size, make, type and characteristics along with wiring diagrams. Where equipment and motor speeds are to be regulated by variable speed drives, the CONTRACTOR shall coordinate, furnish, and exchange all necessary requirements with the respective equipment manufacturers to ensure compatibility and shall submit equipment, shafting, coupling, motor, and variable speed drive shop drawings.

5. Bearings:

a. Information on bearings including but not limited to: type, size, materials of construction.

b. Bearing life calculations including but not limited to: basic dynamic load rating, static load rating, rating life, ABMA L10 reliability (expressed in hours of bearing life) and bearing system life.

6. Gear box design and performance criteria and AGMA service factor, including but not limited to the following:

a. Thermal horsepower rating

b. Bearing type

c. Actual gear ratio

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d. Forced lubrication system: Provide description of equipment, system and instrumentation including but not limited to flow meter, pressure switches, etc.

e. Gear tooth finish quality

7. Piping schematics.

8. Equipment protective device details and connection diagrams.

9. Panel layout drawings, schematic wiring diagrams, and component product data sheets for control panels.

10. A list of spare parts and special tools to be provided.

11. Information on equipment appurtenances including couplings, shaft guards, v-belt drive systems, etc.

12. Any additional information required to demonstrate conformance with the equipment Specifications.

13. Results of critical speed analyses, structural, lateral, and torsional dynamic analyses as required herein and in the individual Specification Sections.

14. Warranty documentation including statement of duration of warranty period and contact phone numbers and addresses for warranty issues.

15. Shipment, delivery, handling, and storage instructions.

16. Installation instructions

17. Manufacturers literature and brochures

18. Materials of construction and associated specifications (such as AISI, ASTM, SAE, etc.), including grade and type.

19. Anchor design in accordance with Section 05 05 23 – Metal Fastening.

20. Intermediate shafting design, including but not limited to general arrangement drawings, engineering data, materials of construction, recommended angular offsets (for cardan universal jointed shafts), and shaft critical speed analyses (including 1st, 2nd, and 3rd critical speed analysis).

21. Coatings: Coating system data and description of coating system, surface preparation and shop painting, including certification that the shop paint is compatible with the finish paint.

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22. Pre-commissioning lubrication oil flushing plan developed by a machinery lubrication specialist, specifically for each piece of lubricated equipment. Plan shall identify, describe procedure, and demonstrate data-based approach to demonstrating achievement of lubricant cleanliness via flushing. Level of lubricant cleanliness shall be as required by equipment manufacturer's written recommendations.

23. Equipment installation lists.

24. Equipment specific requirements for levelness, plumbness, flatness, coplanarity and coplanar surface deviation.

1.04 CLOSEOUT SUBMITTALS

A. Submit warranty documentation in compliance with:

1. Section 01 33 00 – Submittal Procedures

2. Section 01 61 00 – Product Requirements and Options

B. Operation and Maintenance (O&M) manuals shall be submitted in accordance with Section 01 33 00 – Submittal Procedures and Section 01 78 23 – Operations and Maintenance Data.

1.05 MAINTENANCE MATERIALS SUBMITTALS

A. Operation and Maintenance (O&M) manuals shall be submitted in accordance with:

1. Section 01 33 00 – Submittal Procedures

2. Section 01 78 23 – Operations and Maintenance Data

B. Comply with Section 01 78 43 – Spare Parts and Extra Material:

1. For spare parts, extra stock materials, and tools, submit quantity of items specified in associated Specification Section.

2. Submit complete list of spare parts, extra stock materials, maintenance supplies and special tools required for maintenance for one year with unit prices and source of supply. Indicate number/quantity specified and furnished, manufacturer, part number, description,

C. Comply with Section 01 79 00 – Training/Instruction of Owner's Personnel.

D. Lubrication Information:

1. Comply with Specification Section 01 78 23 – Operations and Maintenance Data.

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2. Complete lubrication instructions and lubricant schedule, including manufacturer's recommended lubricant. All lubricants shall be food grade, NSF 61 approved. Schedule shall include frequency of lubricant application, type of lubricant, and instructions regarding lubricant application

1.06 QUALITY ASSURANCE SUBMITTALS

A. Factory testing plan.

B. Factory Test Results shall be submitted and approved prior to shipment of equipment.

C. Field testing plan.

D. Comply with Section 01 75 00 – Checkout and Startup Procedures.

E. Alignment Report:

1. Alignment reports shall contain numerical values to express offset and angular alignment and all other parameters documented in ANSI/ASA S2.75.

2. Alignment reports shall be submitted immediately after each of the following activities have been completed:

a. Preliminary Alignment

b. Final Alignment (at both ambient and operating temperatures)

c. Re-check of alignment

F. Preliminary field test data

G. System field quality control testing

H. Final field test data

I. Certified test reports

1.07 GENERAL INFORMATION AND DESCRIPTION

A. All parts of the equipment furnished shall be designed and constructed for the maximum stresses occurring during fabrication, transportation, installation, testing, and all conditions of operation. All materials shall be new and shall conform to all applicable Sections of these Specifications.

B. All parts of duplicate equipment shall be interchangeable without modification. Manufacturer's design shall accommodate all the requirements of these Specifications.

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C. Equipment and appurtenances shall be designed in conformity with specifications, codes, and reference standards.

D. All bearings and moving parts shall be protected by bushings or other Engineer approved means against wear, and provision shall be made for accessible lubrication by extending lubrication lines and fittings to approximately 30 inches above finished floor elevation.

E. Details shall be designed for appearance as well as utility. Protruding members, joints, corners, gear covers, etc., shall be finished in appearance. All exposed welds on machinery shall be ground smooth and the corners of structural shapes shall be rounded or chamfered.

F. Machinery parts shall conform within allowable tolerances to the dimensions shown on the working drawings.

G. All machinery and equipment shall be safeguarded in accordance with the specifications, codes, and reference standards.

H. All rotating shafts, couplings, or other moving pieces of equipment shall be provided with protective guards of sheet metal or wire mesh, neatly and rigidly supported. Guards shall be removable as required to provide access for repairs.

I. All equipment greater than 100 pounds shall have lifting lugs, eyebolts, etc., for ease of lifting, without damage or undue stress exerted on its components.

J. All manufactured items provided under this Section shall be of current manufacture and shall be the products of manufacturers specializing in the manufacture of such products.

K. Code Compliance, safety, and ergonomics for operating and maintenance personnel accessing equipment shall be considered during shop drawing development, fabrication, and installation. Items to considering include but are not limited to clearances reserved for walking access around all sides, for opening access doors fully, for visual inspection for condition monitoring, and for the performance of maintenance tasks including but not limited to changing filters, replacing belts, maintaining lubrication levels, predictive maintenance and performing diagnostic functions.

1.08 EQUIPMENT WARRANTIES

A. Warranty requirements shall be as specified in Section 01 61 00 – Product Requirements and Options and Section 01 75 00 – Checkout and Startup Procedures. Warranty requirements are supplementary to the individual equipment Specifications.

1.09 DEFINITIONS

A. Comply with Specification Section 01 42 00 – References.

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B. Refer to the specified reference specifications, codes, and standards for definitions applicable to this Specification Section. Additional definitions are included hereafter.

C. Chockplate: A solid steel (or alloy steel) plate with a machined top surface that is grouted to a concrete foundation to support and maintain alignment of a machinery structural steel base plate.

D. Equipment Train: Two or more rotating equipment machinery elements consisting of at least one driver and one driven element joined together by a coupling.

E. Mounting plate: A device used to attach equipment to concrete foundations; includes base plates, soleplates, and chockplates. A mounting plate is a base-support mechanism for the attached machinery and all individual pieces of machinery are expected to be removable from the mounting plate as a single assembly.

F. Operating Temperature (Thermal) Alignment: A procedure to determine the actual change in relative shaft positions within a machinery train from the ambient (not running) condition and the normal operating temperature (running) condition by taking measurements from start-up to normal operating temperature while the machine(s) is (are) operating, or after the shafts have been stopped but the machines are still near operating temperature.

G. Preliminary alignment: The aligning of two adjacent machinery shafts to ensure that final alignment can be achieved without being bolt bound. This is accomplished before grouting (for horizontal machines) and the measurement of piping strain on the machinery.

H. Soleplate: A solid steel (or alloy steel) plate with a machined top surface that is grouted to a concrete foundation to support and maintain alignment of machinery.

PART 2 – PRODUCTS

2.01 GENERAL

A. All like components within a piece of equipment shall be provided by the same manufacturer.

B. Base plates:

1. Top surface of mounting plates shall be machined in locations where equipment supports/feet will contact the plate.

2. Equipment contact points shall be flat and parallel within ASA/ANSI 2.75 tolerances or 0.002-inches per foot, whichever is more stringent, and within related tolerances.

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3. There shall be no paint where equipment supports or feet contact mounting plate.

4. Mounting plate shall be sufficiently rigid to avoid bending or flexing when equipment is installed.

2.02 ANCHORS AND SUPPORTS

A. Comply with the following Specification Sections:

1. Specification Section 05 05 23 – Metal Fastening.

2. Comply with individual equipment Specification Sections.

B. The Contractor shall furnish, install, and protect all necessary guides, bearing plates, anchor and attachment bolts, and all other appurtenances required for the installation of the devices included in the equipment specified. Working Drawings for installation shall be furnished by the equipment manufacturer, and templates shall be used by the Contractor when required in the detailed equipment Specifications.

C. Anchor bolts and fasteners:

1. Anchor bolts shall be designed and provided by the Contractor in accordance with Section 05 05 23 – Metal Fastening, and with the individual equipment Specification Sections.

2. All anchor bolts shall have at least the minimum diameter as required by Section 05 05 23 – Metal Fastening.

3. All anchor bolts, guard bolts, washers, clips, clamps, fasteners, and leveling plate pads, nuts, shims, and jack bolts of any type shall be constructed of 316 stainless steel, unless otherwise specified the individual equipment Specification Sections.

4. Undercutting of anchors or fasteners shall not be permitted.

D. Pipe sleeves as a means for adjusting anchor bolts shall be provided where indicated in the contract documents or required by the equipment manufacturer.

E. The Contractor shall provide all concrete pads or pedestals required for equipment furnished. All concrete equipment pads shall be a minimum of 4” high, unless otherwise shown on the Drawings, and shall be doweled.

2.03 DEFAULT MATERIALS

A. Equipment shall be constructed out of the materials specified in respective individual pumping Specification Sections. Material not specifically called for shall be high-grade, standard commercial quality, free from all defects and imperfection that might affect the serviceability of the product for the purpose for which it is intended.

2.04 STRUCTURAL STEEL

A. Structural steel used for fabricating equipment shall conform to the requirements of Section 05 12 00 – Structural Steel.

B. All materials shall conform to applicable provisions of the AISC Specifications for the design and fabrication of structural steel, and to pertinent ASTM Standard Specifications.

2.05 DISSIMILAR METALS

A. All dissimilar metals shall be isolated in accordance with Section 05 10 00 – Metal Materials and to the satisfaction of the Engineer.

2.06 GALVANIZING

A. Where required by the equipment Specifications, galvanizing shall be performed in accordance with Section 05 05 13 – Galvanizing.

2.07 STANDARDIZATION OF GREASE FITTINGS

A. The grease fittings on all mechanical equipment shall be such that they can be serviced with a single type of grease gun. Fittings shall be “Zerk” type.

2.08 ELECTRICAL REQUIREMENTS

A. All electrical equipment and appurtenances, including but not limited to motors, panels, conduit, and wiring, etc., specified in the equipment Specifications shall comply with the applicable requirements of the Division 26 Specifications and the latest National Electric Code. Motor starters and controls shall be furnished and installed under Division 26 and Division 40 unless otherwise specified in the individual equipment Specification Sections.

B. In the individual equipment Specification Sections, specified motor horsepower is intended to be the minimum size motor to be provided. If a larger motor is required to meet the specified operating conditions and performance requirements, the Contractor shall furnish the larger sized motor and shall upgrade the electrical service (conduit, wires, starters, etc.) at no additional cost to the Owner.

C. Where variable frequency drives (VFDs) are specified, the Contractor shall be responsible for coordinating between equipment supplier and VFD supplier to ensure a complete and operational system. VFDs shall be furnished under Division 26 unless otherwise specified in the equipment Specification. Wherever variable speed drives (VSDs) are specified the same requirements as for VFDs shall apply.

D. Motor starters and controls shall be furnished and installed under Division 26 and Division 40 unless otherwise specified in the individual equipment Specification Sections.

2.09 ACCESSORIES, SPARE PARTS, AND SPECIAL TOOLS

A. Accessories, spare parts, and special tools shall be provided in accordance with Section 01 78 43 – Spare Parts and Extra Material.

2.10 EQUIPMENT IDENTIFICATION

A. All mechanical equipment shall be provided with a substantial stainless-steel nameplate, mechanically fastened with stainless steel hardware in a conspicuous place, and clearly inscribed with:

1. The manufacturer's name
2. Year of manufacture
3. Serial number
4. Principal rating data such as (for example):
    a. Capacity
    b. Pressure
    c. Horsepower
    d. Speed

B. Each piece of mechanical equipment shall also be identified as to name and number by a suitable laminated plastic or stainless-steel nameplate mechanically fastened with stainless steel hardware; for example, "Raw Water Pump #1 (RWP-1)". Coordinate name and number with same on remotely located controls, control panel, and other related equipment.

C. Nameplates shall not be painted over.

PART 3 – EXECUTION

3.01 SHOP TESTING

A. All equipment shall be tested in the shop of the manufacturer in a manner which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents and that it will operate in the manner specified or implied.

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B. No equipment shall be shipped to the project site until the Engineer has been furnished a certified copy of test results and has notified the Contractor, in writing, that the results of such tests are acceptable.

C. A certified copy of the manufacturer's actual test data and interpreted results thereof shall be forwarded to the Engineer for review.

D. If required by the individual equipment Specifications, arrangements shall be made for the Owner/Engineer to witness performance tests in the manufacturer's shop. The Engineer shall be notified ten working days before shop testing commences. Expenses are to be paid by Contractor.

E. Shop testing of electric motors shall conform to:

1. Section 26 05 00 – Basic Electrical Requirements

2. Section 26 05 60 – Low-Voltage Electric Motors

3.02 SHIPMENT, DELIVERY, HANDLING AND STORAGE

A. Shipment, delivery, and handling of equipment and materials shall be in accordance with Section 01 65 00 – Product Delivery Requirements.

B. Storage of equipment and materials shall be in accordance with Section 01 66 00 – Product Storage and Protection Requirements.

C. Shipping plans shall include consideration for protecting bearings and/or other rotating equipment from chatter damage.

D. Any equipment shipped to site that needs further attention shall have a WARNING tag affixed to it with indication of the action that should be taken in preparation for startup. Examples are: Final Lubrication, Mechanical Seal not in final position, etc.

3.03 MANUFACTURER’S FIELD SERVICES

A. Manufacturer’s field services shall be in accordance with Section 01 75 00 – Checkout and Startup Procedures.

B. The Contractor shall arrange for a qualified factory trained Technical Representative from each manufacturer or supplier of equipment who is regularly involved in the inspection, installation, start-up, troubleshooting, testing, maintenance, and operation of the specified equipment. Qualification of the Technical Representative shall be appropriate to the type of equipment furnished and subject to the approval of the Engineer and the Owner. Where equipment furnished has significant process complexity, furnish the services of engineering personnel knowledgeable in the process involved and the function of the equipment. When necessary, the Contractor shall

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schedule multiple Technical Representatives to be present at the same time for the purpose of coordinating the operation of multiple pieces of related equipment.

C. Services of the Technical Representative will require a minimum of two (2) site visits, one for installation and testing and one for startup and training and will be for the minimum number of days recommended by the manufacturer and approved by the Engineer but will not be less than the number of days specified in individual equipment Sections. Additional site visits may be required as described below and in the equipment Specifications. The Engineer reserves the right to require that any unused person-days from any visit be applied to any other specified visit.

D. For each site visit, the Technical Representative shall submit jointly to the Owner, the Engineer, and the Contractor a complete signed report of the results of his inspection, operation, adjustments, and testing. The report shall include detailed descriptions of the points inspected, tests and adjustments made, quantitative results obtained if such are specified.

E. The manufacturer's Technical Representative shall provide the following services.

1. Installation: The Technical Representative shall inspect the installed equipment to verify that installation is in accordance with the manufacturer’s requirements. Where required by individual equipment Specifications, the Technical Representative shall also supervise the installation of the equipment.

2. Testing: After installation of the equipment has been completed and the equipment is presumably ready for operation, but before it is operated by others, the Technical Representative shall inspect, operate, test, and adjust the equipment as required to prove that the equipment is in proper condition for satisfactory operation under the conditions specified. Unless otherwise noted in the signed site visit report, the report shall constitute a certification that the equipment conforms to the requirements of the Contract and is ready for startup and that nothing in the installation will render the manufacturer's warranty null and void. The report shall include date of final acceptance field test, as well as a listing of all persons present during tests.

3. Startup: The Technical Representative shall start up the equipment for actual service with the help of the Contractor. If equipment or installation problems are experienced, the Contractor and the representative shall provide the necessary services until the equipment is operating satisfactorily and performing according to the Specifications at no additional cost to the Owner. Unless otherwise noted in the signed site visit report, the report shall constitute a certification that the equipment conforms to the requirements of the Contract and is ready for permanent operation and that nothing in the installation will render the manufacturer's warranty null and void.

4. Training: Training shall be provided in accordance with Section 01 79 00 – Instruction of Owner's Personnel.

5. Services after Startup: Where required by the individual equipment Specifications, the Technical Representative shall return to the project site thirty (30) days after the startup date to review the equipment performance, correct any equipment problems, and conduct operation and maintenance classes as required by the Owner. This follow-up trip is required in addition to the specified services of Technical Representative prior to and during equipment startup. At this time, if there are no equipment problems, each manufacturer shall certify to the Owner in writing that his equipment is fully operational and capable of meeting operating requirements. If the equipment is operating incorrectly, the Technical Representative will make no certification to the Owner until the problems are corrected and the equipment demonstrates a successful thirty (30) day operating period.

F. The Contract amount shall include the cost of furnishing the Technical Representative for the minimum number of days specified, and any additional time required to achieve successful installation and operation. The times specified for services by the Technical Representative in the equipment Specifications are exclusive of travel time to and from the facility and shall not be construed as to relieve the manufacturer of any additional visits to provide sufficient service to place the equipment in satisfactory operation.

G. The Contractor shall notify the Engineer at least 14 days in advance of each equipment test or Owner training session.

H. The Technical Representative shall sign in and out at the office of the Engineer's Resident Project Representative on each day the Technical Representative is at the project.

3.04 INSTALLATION

A. The Contractor shall obtain written installation manuals from the equipment manufacturer prior to installation. Equipment shall be installed strictly in accordance with recommendations of the manufacturer. A copy of all installation instructions shall be furnished to the Engineer's field representative one week prior to installation.

B. The Owner's field representative (e.g., the Engineer or similar) shall witness all activities involved with equipment installation.

C. The Contractor shall have on hand personnel, construction equipment, and machinery of capacity to facilitate the work and to handle all emergencies encountered in work of this character. To minimize field erection problems, mechanical units shall be factory assembled insofar as practical.

D. Equipment shall be erected in a neat and workmanlike manner on the foundations at the locations and elevations shown on the Drawings.

E. All equipment sections and loose items shall be match-marked prior to shipping.

F. The Contractor shall furnish oil and grease for initial operation and testing. The manufacturer and grades of oil and grease shall be in accordance with the recommendations of the equipment manufacturer.

G. Leveling and Grouting:

1. Set equipment to dimensions shown on drawings. Dimensions shall be accurate to +/- 1/16 inch except as otherwise specified, required, or indicated on the drawings.

2. Base plate Surface Preparation – Prior to setting equipment and grouting, inspect and clean equipment mounting base plates, pads, feet, and frames to remove all grease, rust, paint, and dirt.

3. Wedges (i.e., tapered shims) shall not be used for leveling, aligning, or supporting equipment.

4. General Equipment Leveling:

a. Non-rotating Equipment: Set level to +/- 1/16 inch per 10-foot length (0.005 inch per foot) unless manufacturer's requirements are more stringent.

b. Rotating Equipment: Install, set to the most stringent of the following requirements for levelness, plumbness, flatness, coplanarity and coplanar surface deviation:

1) ASA-ANSI S2.75, Shaft Alignment Methodology. Comply with tolerance ranges scheduled at the end of this Specification Section.

2) Individual equipment Specifications

3) Manufacturer's pre-printed written requirements.

4) When the equipment manufacturer's pre-printed tolerances are more stringent than those stated in ASA/ANSI 2.75 or more stringent than the individual pump Specification, the cost of field machining sole plates or precision grouting sole plates shall be covered by the Contractor.

c. Shims or leveling nuts shall be used unless equipment is furnished with leveling feet. Set shims flush with equipment base plate edges. When grouting is required, equipment shall be shimmed to allow a minimum of one-inch grout thickness. Grout shall cover shims at least 3 inches. Final level check shall be held for inspection and approval by Engineer before proceeding.

d. Equipment shall be leveled by first using sitting nuts on the anchor bolts, and then filling the space between the equipment base and concrete pedestal with epoxy base plate grout, unless alternate methods are recommended by the manufacturer and are acceptable to the Engineer (e.g., such as shim leveling pumps, or chemical grout).

5. Grouting

a. Comply with Section 03 60 00 – Grout.

b. Grout Materials:

1) Rotating Equipment: Grout for rotating equipment shall be epoxy base plate grout. Cementitious grouts shall not be accepted for rotating equipment.

2) Non-rotating Equipment: Grout shall be as per the non-rotating equipment manufacturer's pre-printed written installation instructions and shall be subject to the Engineer's approval.

c. Fill pipe sleeves with grout, after bolt alignment is proven, and prior to placing grout under equipment bases.

d. Concrete Surface Preparation: Roughen concrete equipment pad surface by chipping, removing laitance, and unsound concrete. Clean area of all foreign material such as oil, grease, and scale.

1) When grouting with cementitious grouts is approved, the contact area of the concrete equipment pad shall be saturated with water at least 4 hours prior to grouting, removing excess water ponds.

e. Application:

1) Place grout after the equipment base has been set and its initial alignment and level have been approved.

2) Form around the base, mix grout, and place in accordance with the grout manufacturers published instructions.

3) Grout mixture shall be flowable. Dry packing of grout shall not be permitted.

4) Eliminate all air or water pockets beneath the base using a drag chain or rope.

5) Grout voids detectable by tapping the top of the base plate with a hammer shall be grounds for removal and reinstallation of the work.

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f. Finishing: Point the edges of the grout to form a smooth 45-degree slope.

g. After cementitious grout has cured (not before 3 days after placement) paint exposed surfaces of grout with shellac.

h. Level Verification. After grout has cured, and immediately prior to final drive alignment, recheck equipment for level and plumb. Re-level and square, as necessary. Hold final checks for inspection and approval by Engineer.

6. Inspect for and remove all machining burrs or thread pulls in female holes on mating surfaces of mounting frame and machine feet.

3.05 ALIGNMENT

A. For equipment that requires field alignment and connections, the Contractor shall provide the services of the manufacturer's qualified mechanic, millwright, or machinist, to align the equipment and motor prior to making piping connections or anchoring the equipment base. Alignment shall be as specified herein.

B. Rotating Equipment Shaft Alignment: Assembled equipment shafts shall be set to comply with the most stringent of the following tolerance requirements for shaft runout and shaft-to-shaft alignment tolerances expressed in angle at flex plane, in offset and angularity and/or in offset per tolerance plane separation:

1. ASA-ANSI S2.75, Shaft Alignment Methodology. Comply with tolerance ranges scheduled at the end of this Specification Section.

2. Individual equipment Specifications

3. Manufacturer’s pre-printed written requirements.

C. Use the machined surfaces on which the equipment sets for the base/mounting frame leveling plane. Use the machined shaft surface for equipment leveling plane.

D. Sprocket and Sheave Alignment:

1. Check shaft mounted components for face runout and eccentricity (outside diameter) runout by magnetically mounting a dial indicator on a stationary base and indicating over 360 degrees on a continuous machined surface at the outside diameter of the component. Maximum allowable total indicated face runout and eccentricity for sprockets and sheaves will be per ANSI Standard B29.1-1975.

2. Drive and driven sheaves shall lie in the same plane. The sum of parallel and angular sheave misalignment measured across the span length of the belt and angular misalignment perpendicular to the belt span length shall each not exceed ½ degree or the belt manufacturer’s recommendation whichever is more stringent.

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E. Belt tensioning: Set drive belt tension to manufacturer's specification for the belt type. Recheck alignment after drive tensioning.

F. Thermal/Mechanical Growth: Thermal/mechanical growth corrections for driver and driven machines will be used in vertical and horizontal alignment where applicable. The equipment manufacturer will determine thermal/mechanical growth applicability for any machine and provide the correction offsets to be used.

3.06 FIELD TESTING

A. Field testing shall be in accordance with Section 01 75 00 – Checkout and Startup Procedures.

B. All equipment shall be set, aligned, and assembled in conformance with the manufacturer's drawings and instructions. Provide all necessary calibrated instruments to execute performance tests. Submit report certified by the pump manufacturer’s representative.

C. Preliminary Field Tests, Yellow Tag.

1. As soon as conditions permit, after the equipment has been secured in its permanent position, the Contractor shall:

   a. Verify that the equipment is free from defects.

   b. Check for alignment as specified herein.

   c. Check for direction of rotation.

   d. Check motor for no load current draw.

2. Contractor shall flush all bearings, gear housings, etc., in accordance with the pre-commissioning lubrication oil flushing plan and manufacturer’s pre-printed written recommendations, to remove any foreign matter accumulated during shipment, storage or erection. Lubricants shall be added as required by the manufacturer's instructions.

3. When the Contractor has demonstrated to the Engineer that the equipment is ready for operation, a yellow tag will be issued. The tag will be signed by the Engineer, or his assigned representative and attached to the equipment. The tag shall not be removed.

4. Preliminary field tests, yellow tag, must be completed before equipment is subjected to final field tests, blue tag.

D. Final Field Tests, Blue Tag

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1. Upon completion of the above, and at a time approved by the Engineer, the equipment will be tested by operating it as a unit with all related piping, ducting, electrical and controls, and other ancillary facilities.

2. The equipment will be placed in continuous operation as prescribed or required and witnessed by the Engineer or his assigned representative and the Owner or his assigned representative.

3. The tests shall prove that the equipment and appurtenances are properly installed, meet their operating cycles and are free from defects such as overheating, overloading, and undue vibration and noise. Operating field tests shall consist of the following:

    a. Check equipment for excessive vibration and noise.

    b. Check motor current draw under load conditions. The rated motor nameplate current shall not be exceeded. The rated motor nameplate horsepower shall not be exceeded when a torque transducer is provided.

    c. Recheck alignment where applicable, after unit has run under load for a minimum of 24 hours.

E. Additional field testing recommended by the manufacturer shall be performed at no cost to the Owner.

F. Until final field tests are acceptable to the Engineer, the Contractor shall make all necessary changes, readjustments, and replacements at no additional cost to the Owner.

G. Upon acceptance of the field tests, a blue tag will be issued. The tag will be signed by the Engineer and attached to the unit. The tag shall not be removed, and no further construction work will be performed on the unit, except as required during start-up operations and directed by the Engineer.

H. Defects which cannot be corrected by installation adjustments will be sufficient grounds for rejection of any equipment.

I. All costs in connection with field testing of equipment such as lubricants, temporary instruments, labor, equipment, etc., shall be borne by the Contractor. Power, fuel, chemicals, water, etc. normally consumed by specific equipment shall be supplied by the Owner unless otherwise specified in the individual equipment Specifications.

J. The Contractor shall be fully responsible for the proper operation of equipment during tests and instruction periods and shall neither have nor make any claim for damage which may occur to equipment prior to the time when the Owner formally takes over the operation thereof.

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K. Field testing of electric motors shall be in accordance with Section 26 05 60 – Low-Voltage Electric Motors and Section 26 05 00 – Basic Electrical Requirements.

3.07 VIBRATION TESTING

A. Vibration testing shall be in accordance with Section 01 75 00 – Checkout and Startup Procedures.

3.08 FAILURE OF EQUIPMENT TO PERFORM

A. Any defects in the equipment, or failure to meet the guarantees or performance requirements of the Specifications shall be promptly corrected by the Contractor by replacement or otherwise.

B. If the Contractor fails to make these corrections, or if the improved equipment shall fail again to meet the guarantees or specified requirements, the Owner, notwithstanding his having made partial payment for work and materials which have entered into the manufacture of said equipment, may reject said equipment and order the Contractor to remove it from the premises at the Contractor's expense.

C. The Contractor shall then obtain specified equipment to meet the contract requirements or upon mutual agreement with the Owner, adjust the contract price to reflect not supplying the specific equipment item.

D. In case the Owner rejects said equipment, then the Contractor hereby agrees to repay to the Owner all sums of money paid to him for said rejected equipment on progress certificates or otherwise on account of the lump sum prices herein specified.

E. Upon receipt of said sums of money, the Owner will execute and deliver to the Contractor a bill of sale of all his rights, title, and interest in and to said rejected equipment; provided, however, that said equipment shall not be removed from the premises until the Owner obtains from other sources other equipment to take the place of that rejected.

F. Said bill of sale shall not abrogate Owner's right to recover damages for delays, losses, or other conditions arising out of the basic contract.

3.09 PAINTING

A. The equipment and motor shall be painted. All surface preparation, shop painting, field repairs, finish painting, and other pertinent detailed painting specifications shall conform to applicable paragraphs of Section 09 90 00 – Painting.

B. All shop coatings shall be compatible with proposed field coatings.

C. All inaccessible surfaces of the equipment, which normally require painting, shall be finished painted by the manufacturer.

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D. Gears, bearing surfaces, and other unpainted surfaces shall be protected prior to shipment by a heavy covering of rust-preventive compound sprayed or hand applied which shall be maintained until the equipment is placed in operation. This coating shall be easily removable by a solvent.

3.10 WELDING

A. The Equipment Manufacturer's shop welding procedures, welders, and welding operators shall be qualified and certified in accordance with the requirement of AWS D1.1 "Structural Welding Code - Steel", AWS D1.2 "Structural Welding Code - Aluminum" of the American Welding Society, or AWS D1.6 “Structural Welding Code – Stainless Steel”, as applicable.

B. The Contractor's welding procedures, welders, and welding operators shall be qualified and certified in accordance with the requirements of AWS D1.1 "Structural Welding Code - Steel", AWS D1.2 "Structural Welding Code - Aluminum" of the American Welding Society, or AWS D1.6 “Structural Welding Code – Stainless Steel “as applicable.

C. The Contractor shall perform all field welding in conformance with the information shown on the Equipment Manufacturer's drawings regarding location, type, size, and length of all welds in accordance with "Standard Welding Symbols" AWS A2.0 of the American Welding Society, and special conditions, as shown by notes and details.

END OF SECTION

SECTION 46 21 12

MECHANICALLY CLEANED MULTI-RAKE TYPE BAR SCREENS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, paint, shop test, deliver, install, adjust, field test, and place into satisfactory operation three (3) multi-rake mechanical bar screen, complete with all necessary accessories specified herein suitable for removing screenings from sanitary sewage as a complete and integrated package to ensure proper coordination, compatibility, and operation of the system.

B. The mechanical bar screen and all its appurtenances under this Section shall be suitable for the operation in a sanitary sewer pumping station system. The sanitary sewage flow may be expected to contain waste solids, rags, flushable wipes, vegetable debris, lumber, rocks, sand, silt, petroleum products, industrial solvents, animal fats, and oils. The sanitary sewage will have a temperature of thirty-two to eighty degrees Fahrenheit (32 to 80) and will have a pH which may range from six to ten (6 to 10), the equipment will be located indoors, and the system must be designed to withstand freezing temperatures during power outages without damage.

C. Screens will be located in concrete channels and will remove screened material from the sanitary sewage. Screened materials will be discharged onto a screw conveyor as specified in Section 46 76 42 – Screw Conveyors. The screw conveyor will discharge conveys screening material to a washer-compactor as specified in Section 46 21 73 – Screenings Washer-Compactor, which discharge into a dumpster. In the event the screw conveyor is not operating, the screenings will discharge into bypass containers via manually operated conveyor bypass chutes which are to be furnished by the screen manufacturer.

D. The layout, dimensions, and elevations shown on the Contract Drawings are representative of the mechanical bar screens. Any costs for re-design, materials, or construction due to requirements of the mechanical bar screen equipment ultimately furnished shall be the responsibility of the Contractor.

E. Control of the mechanical bar screens will be from the Screen Local Panel (LCP) and local control station (LCS) as specified herein.

F. Related Sections:

1. Section 03 21 00 – Reinforcing Steel

2. Section 05 05 23 – Metal Fastening

3. Section 26 05 60 – Low Voltage Electric Motors

4. Section 40 05 97 – Piping and Equipment Identification Systems

5. Section 40 61 13 – Process Control System General Provisions
6. Section 40 61 21 – Process Control System Testing
7. Section 40 61 96 – Process Control Descriptions
8. Section 40 63 43 – Programmable Logic Controllers
9. Section 40 67 00 – Control System Equipment Panels and Racks
10. Section 40 72 76.26 – Level Switches (Floats)
11. Section 40 73 23.01 – Radar Level Meters – Two wire
12. Section 40 78 00 – Panel Mounted Instruments
13. Section 40 78 56 – Isolators, Intrinsically-Safe Barriers, and Surge Suppressors
14. Section 46 00 00 – Equipment General Provisions
15. Section 46 21 73 – Screenings Washer-Compactor
16. Section 46 76 42 – Screw Conveyors

1.02 SUBMITTALS

A. Product data shall comply with Section 01 33 00 – Submittal Procedures.

B. The Contractor shall provide the submittals identified in Section 46 00 00 – Equipment General Provisions in addition to the submittals identified herein:

1. Working Drawings (see additional information below)
2. Operation and Maintenance Manuals
3. Training Lesson Plans
4. List of Spare Parts, Special Tools, and Supplies
5. Table of recommended lubricants with contact information and addresses for lubricant suppliers
6. Shop Testing Plan (including description of testing arrangement), Field Testing and Startup Plan
7. Reports of Shop Tests
8. Reports of Field Tests and Start Up

9. List of Manufacturer's Service Facilities and Service Capabilities

10. Reports of Manufacturer's Representative Site Visits

C. Working Drawings shall include, but not limited to the following:

1. Manufacturer experience and listing of successful operation in other facilities of equipment of similar to that proposed for this project.

2. Certification of manufacturing facility, ISO 9001, or similar quality control protocols.

3. A copy of this Specification Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements or those parts which are to be provided by the Contractor or others. Check marks shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up Specification Sections, along with justification(s) for any requested deviations to the specification requirements shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

4. A copy of the Contract Document control diagrams and process and instrumentation diagrams, electrical drawings with addenda updates, which apply to the equipment in this Section marked to show specific changes necessary for the supplied equipment. If no changes are required, the working drawing shall be marked "No Changes Required."

5. Manufacturer's equipment specifications and data sheets, which shall include but not be limited to the following information:

a. Parts listed with materials of Construction and methods of fabrication.

1) Procedures for the cleaning, decaling, passivation, and detection of iron contamination in stainless steel in accordance with ASTM A380 shall be submitted for approval prior to beginning of work.

b. Weights of equipment component parts assembled weight of equipment, and total shipping weight. As applicable, include dynamic loads and weight when full and all loads transmitted to supporting structure.

c. Product data sheets for all screen components.

d. Design performance data including, but not limit to, screen rotative speed, cleaning intervals at normal and high speed, screenings removal capacity at normal and high speed, maximum rated capacity, maximum differential head across bar rack for structural design, and maximum head-loss at peak flow.

e. External utility requirements for power for each component.

6. Complete assembly, layout, installation, and shop drawings, with clearly marked dimensions, and details. Details shall include but not limited to the following information:

   a. Detailed structural, mechanical, and electrical drawings showing equipment fabrications and interface/ connections with other items or Work.

   b. Equipment cross-section drawings.

   c. Anchorage and baseplate details and locations.

   d. Anchoring plan will include information on plan to avoid cutting existing reinforcing steel in accordance with Section 03 21 00 – Reinforcing Steel.

   e. Screening discharge chute details.

   f. Cleaning rake and scraper details.

7. The following calculations shall be submitted:

   a. Calculations of maximum head-loss and velocity at peak flow for clean screen and blinded screen (0% and 30%) conditions.

   b. Calculations of screen strength to handle maximum differential water level.

   c. Bearing life calculations per AFBMA Standards.

   d. Detailed summaries of structural anchorage, and process design calculations. Structural calculation summary shall be signed and sealed by a Professional Engineer currently registered in the State of New York.

8. Certification of welders, steamfitters, and other workforces.

9. Painting and Coating details.

10. Equipment nameplate data.

11. Manufacturer's delivery, storage, and handling requirements including rigging plan for screen.

12. Detailed Manufacturer's installation instructions and recommendations, including installation requirements requiring coordination with Contractor and/or other equipment suppliers.

13. Motor Data as specified in Section 26 05 60 – Low Voltage Electric Motors.

14. Control component data as specified in Section 40 61 13 – Process Control System General Provisions.

15. Testing and Adjusting instructions.

16. Equipment warranty information.

D. Submit location of the nearest permanent service headquarters of the screen and motor manufacturer for the screen and motor submitted.

E. Warranty documentation shall be submitted in compliance with:

1. Section 01 33 00 – Submittal Procedures

2. Section 01 77 19 – Closeout Requirements

F. Operation and Maintenance (O&M) manuals shall be submitted in accordance with:

1. Section 01 33 00 – Submittal Procedures

2. Section 01 78 23 – Operations and Maintenance Data

3. Section 46 00 00 – Equipment General Provisions

G. Training lesson plans shall be submitted in accordance with:

1. Section 01 33 00 – Submittal Procedures

2. Section 01 79 00 – Instruction of Owner's Personnel

3. Section 46 00 00 – Equipment General Provision.

1.03 SPARE PARTS / TOOLS / SUPPLIES LIST

A. The Contractor shall provide spare parts and special tools necessary to service, disassemble, repair, and adjust the equipment furnished under this specification, as specified in Section 01 78 43 – Spare Parts and Extra Material and Section 01 77 19 –

Closeout Requirements. Spare parts shall be tagged in accordance with Section 40 05 97 – Piping and Equipment Identification Systems.

B. All spare parts shall be of the same material specified in this Section. At minimum, the following spare parts shall be provided for the Contract:

1. Two (2) cleaning rake assemblies.

2. One (1) complete set of drive chains (2 chains) for complete change out of one (1) screen.

3. One (1) complete set of upper sprockets (2 pieces) and lower sprockets (2 pieces) assembly for complete change out of one (1) screen.

4. One (1) pair of lower stub shaft assembly (2 pieces).

5. One (1) scraper assembly

6. One (1) motor and gearbox assembly.

7. Provide special tools required for routine maintenance.

C. Provide electric motor spare parts in accordance with Section 26 05 60 – Low-Voltage Electric Motors.

D. Provide instrumentation and control system spare parts in accordance with Division 40 Process Interconnection.

E. The Contractor shall furnish such oil, grease, and any special lubricants that are necessary for the proper operation of the equipment provided under this specification.

1. The oil, grease, and special lubricants furnished shall be sufficient for the required operation of the equipment prior to its final acceptance, and for the operation of the equipment one (1) year after final acceptance.

2. The oil, grease, and special lubricants furnished under this Specification shall, wherever possible, be standardized and consolidated with those furnished other Specifications, as specified in Section 01 78 23 – Operation and Maintenance Data.

1.04 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall deliver, store, and handle the equipment and materials provided under this Specification in accordance with manufacture’s instruction and as specified in Section 01 65 00 – Product Delivery Requirements, and Section 01 66 00 – Product Storage and Protection Requirements.

1.05 QUALITY ASSURANCE

A. The Contractor shall provide evidence to the Engineer that the manufacturer has a minimum of ten (10) years' experience, in the design, manufacture, and supervision of installation of equipment of the type required under this Specification at locations within the United States.

B. The Contractor shall provide evidence to the Engineer that equipment which was designed and manufactured by the manufacturer, and which is similar to the equipment required under this Specification, has been in continuous and successful operation in at least five (5) separate facilities for the past five (5) years at locations within the United States. The design flow rates, and screen length and widths of the installed equipment shall not be less than thirty percent (30%) of the values listed in this Section.

C. The Contractor shall be responsible for coordinating all details of the bar screen equipment with other related parts of the Work, including verification that all structures, piping, wiring, and equipment components are compatible. The Contractor shall be responsible for all structural and other alterations in the Work required to accommodate equipment differing in dimensions or other characteristics from that contemplated in the Contract Drawings or Specification.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Equipment/Materials provided under this Specification shall be as manufactured (including all standard equipment, unless otherwise specified) by:

1. Huber Technology
2. Headworks International
3. Vulcan Industries
4. Or Approved Equal

B. The Contractor shall supply products modified as necessary by the manufacturer to provide the specified features and to meet the specified operating conditions. The screens and controls shall be provided by a single supplier who will take full responsibility for the system.

2.02 MATERIALS / EQUIPMENT

A. General:

1. The heavy-duty equipment specified herein is intended to be standard equipment for use in a screenings removal system, specifically to separate larger, solid, and semi solid debris, and floating matter from sanitary sewage.

2. The screens shall be suitable for operation under the conditions as specified in Schedule 46 21 12 – 1.

3. The only obstructions in the channels shall be the bar rack, frame, and rake mechanism. Except for the bottom bar rack and channel wall bracket anchoring bolts, all structural supports and fasteners shall be above the channel wall so they do not interfere with flow.

4. Drive chains, chain guides, chain sprockets, bearings, axles, and bar racks shall be fully replaceable without having to remove the screen from the channel.

5. The system shall be designed such that no routine maintenance of any element below the operating floor as specified in Schedule 46 21 12 – 1 is required.

6. All components, including the gear reducer shall be designed to withstand, without damage or permanent distortion, the full stalling torque of the drive motor.

7. The screen shall be structurally capable of withstanding all forces involved in the operation in a sewer system, including full bar rack blinding resulting in a maximum differential head as specified in Schedule 46 21 12-1 and an impact force equivalent to a two hundred (200) pound object traveling at rate of three (3) feet per second.

8. All electrical appurtenances furnished by the equipment Manufacturer shall be rated for Class 1, Division 1, Group D hazardous location.

9. Screens shall be fabricated in sections to accommodate limited access in the Mechanical Screen Building.

B. Materials of Construction:

1. The materials specified below are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose.

Component	Material
Bar rack	AISI, type 316 stainless steel
Dead plate	AISI, type 316 stainless steel

Component	Material
Discharge chute	AISI, type 316 stainless steel
Hinged bypass chute	AISI, type 316 stainless steel
Cleaning rake, rake arms, and wiper	AISI, type 316 stainless steel
Side frames	AISI, type 316 stainless steel
Fasteners and miscellaneous hardware	AISI, type 316 stainless steel
Dielectric isolation pads and grommets	Neoprene or EPDM
Connecting arms (rake arms excluded)	AISI, type 316 stainless steel
Sprockets	AISI, type 316 stainless steel
Chain	AISI, type 316 stainless steel or type 17-4PH hardened stainless steel
Chain rollers	Type 316 Stainless steel or Polyamide
Scraper	AISI, type 316 stainless steel
Wiper Blade	Neoprene or UHMW polyethylene
Upper Bearings	Cast steel, antifriction, rolling element type, grease lubricated
Submerged Bearings	UHMWPE or silicon carbide
Shafting	AISI, type 316 stainless steel
Stub Shaft	AISI, type 316 stainless steel or white cast iron
Covers	AISI, type 316L stainless steel and clear polycarbonate
Anchor Bolts	AISI, type 316 stainless steel
Grease Line	Stainless steel tubing, ASTM A269, Grade TP316L, with stainless steel compression fittings; or stainless-steel pipe, ASTM A312, Grade TP316L, Schedule 40S, with threaded stainless-steel fittings
Anti-Seize Thread Lubricant	Provide manufacturer’s standard product

C. Frame:

1. Side frames shall be three-sixteenth (3/16)-inch thick minimum thickness, suitably reinforced to support all loads.

2. Support beams and wrap-around stainless steel stiffeners shall be provided above the maximum waterline. Beams and stiffeners shall be minimum three-sixteenth (3/16)-inch thick, U-shape.

3. Frames shall be securely fastened to the top of the concrete channels with stainless steel adhesive anchors designed by the screening system manufacturer.

4. Provide and install minimum one-quarter (1/4) inch thick EPDM flaps to seal the screen to the channel walls. EPDM flaps shall be bolted to the frame using fasteners on a minimum of six (6) inch centers.

5. Mounting brackets shall be furnished on the sides of the screen that are fixed to the top of the channel. Mounting brackets shall be furnished on the back of the screen that are fixed to the sides of the channel. The brackets shall not be less than 3/8-inch thick 316 stainless steel anchored to the wall

6. Frame shall be secured to the channel invert by a bolted, 3/8-inch thick Type 316 stainless steel anti-reversion bracket.

7. Frame section shall be provided with a minimum of four (4) lifting lugs welded to the upper end of the frame sections.

D. Dead Plate:

1. The dead plate shall be constructed of three-sixteenth (3/16)-inch minimum thickness and welded or bolted to the side frames of the screen.

2. The dead plate shall extend from the bar rack to the point of screenings discharge.

3. Dead plate shall be true and flat such that a close clearance between the raking tines and the plate can be maintained during the cleaning cycle.

4. The back side of the dead plate shall be constructed to guarantee a maximum gap between rake bar and dead plate, leading to the discharge chute without interruption.

E. Bar Rack:

1. Bars shall be individually field-replaceable or replaceable in manageable sections. Each replaceable bar section shall not weight more than 350 lbs.

2. Bars shall be affixed to the frame of the screen using fasteners. The framework of the bar rack shall be sufficiently braced and stiffened to form a rigid structure, such that the bar screen supports the load to meet the Maximum Differential Water Level for screen design specified in the Schedule 46 21 12 – 1.

3. The bar rack shall be precisely constructed to provide clear openings as specified in Schedule 46 21 12 – 1.

4. Bars shall be constructed having a continuous taper bar (i.e., trapezoidal cross-section) or teardrop shape:

    a. Taper bar shall have a minimum leading-edge thickness of 5/16-inch.

    b. Teardrop shape shall have a minimum leading-edge thickness of one-quarter (1/4) inch.

    c. The orientation of the bars shall minimize the potential for screening materials wedging between the bars.

5. Bars shall be extended from the bottom of the channel to the bolted to a dead plate that extends to the point of screenings discharge.

F. Cleaning Rake:

1. Rakes shall approach the channel invert from upstream side of screen and rake upward at the upstream face with tines between the bars.

2. The rakes shall operate in guides on each side of screen frame to ensure engagement and to clean the bars from the upstream side of the screen.

    a. Engagement of the rake tines into the bar spacings shall be by mechanical means.

    b. Engagement of the rake tines into the bar spacings by the dead weight of the rake or chain mechanism will not be acceptable.

3. The rake mechanism shall consist of multiple rakes affixed to the roller chain with spacing to meet the cleaning interval and screening removal capacity as specified in Schedule 46 21 12 – 1. Rake teeth shall be designed to easily engage with the bar openings.

4. The rake shall have a minimum capacity of 0.133 cubic feet per foot of rake head width. During each cleaning cycle, the rake tines shall engage the bottom of the screen field at the channel invert.

5. Rake tines shall have a tooth profile machined from a single continuous bar of thickness and depth to ensure adequate stiffness and strength to cope with the required duty cycle.

6. Each rake shall be designed such that screenings will not wrap around the rake tines and will not fall back into the sewage flow during the screening cycle. The

rake tines shall penetrate the screen field sufficiently to ensure that screenings are completely removed during each cleaning cycle.

G. Chains:

1. Each mechanically cleaned screen shall be provided with two (2) continuous catenary loops, one on each side of the screen.

2. Roller type chains shall be made of high tensile strength and resistance to corrosion.

a. Chain pins shall be constructed of stainless steel and hardened to Rockwell 26 HRC with a minimum weight of nine (9) lbs./ft.

b. Chain shall be able to withstand, without damage or permanent distortion, the full stalling torque of the drive motor.

c. The average ultimate strength of the assembled chain shall be minimum twenty-seven thousand (27,000) pound-force (one hundred twenty thousand [120,000] Newtons).

3. Chain Guide:

a. Each chain shall be provided with an L-profile, Type 316L stainless steel chain guide securely fixed to the side members of the screen frame for the full length of travel.

b. Thickness of chain guide shall be three sixteenth (3/16)-inch minimum.

c. Chain guide shall be bolted to the frame so that they can easily be replaced.

4. Chain guide shall be full height of travel and the location of chain guide shall minimize obstruction to flow.

H. Chain Sprockets:

1. Each mechanically cleaned screen shall be provided with a total of four (4) chain sprockets.

2. The two (2) upper chain sprockets shall be installed on a drive shaft and be supported by a grease lubricated bearing.

a. Drive shaft shall be capable of withstanding two hundred percent (200%) percent of normal input torque.

b. The shaft shall drive both chain assemblies and be equipped with an adjustable screw type take-up providing for a six (6)-inch adjustment for the

screen chain. Take-up screw shall be stainless steel construction. Chain tensioning shall be achieved by adjusting the take-up screw.

1) Where required, each screen shall have a hydraulic tensioning assist. This shall consist of a hydraulic “bottle” type jack positioned on each side of the tensioning take up assembly.

2) The jacks shall engage the take up assembly to assist in tensioning the chain. The jacks shall be for positioning assistance only and shall not be used to maintain chain tension.

3) If required by design, provide hydraulic bottle jack to assist. The jacks shall be removable and interchangeable for use on each screen. Two (2) jacks per screen shall be provided.

c. Upper sprocket bearings shall be flange mounted to the side frame and have a minimum AFBMA B-10 life of fifty thousand (50,000) hours. The bearings shall be furnished with externally accessible grease fittings.

d. A seal shall be provided around the shaft where each shaft passes through the screen frame.

3. The two (2) lower chain sprockets shall be mounted on stub shafts and be designed to operate in a submerged condition.

a. The bearings for the lower submerged sprockets shall be self-lubricating, abrasion resistant UHMWPE or silicon carbide slide bushing and be maintenance free.

b. A coated ceramic collar or hardened steel shall be bonded onto the stub shaft to provide increased protection against wear.

c. The lower sprockets shall operate in a recess of the frame and not be directly exposed to the incoming flow.

4. The screen manufacturer shall coordinate the sprocket diameter, pitch, tooth width, and hub diameter to meet the performance requirements.

I. Discharge Chute:

1. Each discharge Chute shall form a leak-free totally enclosed chute and shall be constructed of one sixteenth (1/16)-inch minimum 316 stainless steel sheet bolted to the frame.

2. Hoppers shall have an angle no less than 60 degrees from horizontal to provide a transition from the width of the mechanical screen discharge to the conveyor.

3. Each chute shall be oriented to deposit screenings onto the screw conveyor. The Discharge chute shall be designed to provide integral bypass hopper to allow conveyor bypass as shown in Contract Drawings.

4. Each discharge chute shall be designed to receive screenings bypass chute as shown on the Contract Drawings. The Contractor shall be responsible for a complete coordinated design of the discharge and bypass chute including supporting system, screens, screenings conveyor, and the bypass screenings containers.

J. Discharge System:

1. Screenings transported to the top of the screen shall be discharged positively by means of a scraper to the discharge chute.

2. The scraper shall be designed to pivot to allow cleaning of each rake on each cleaning cycle and cushioned during travel to the rest position. The wiper arms shall be designed to return the wiper quietly and without shock.

3. The primary removal device shall be the rake wiper, of minimum 5/32-inch-thick stainless steel, shall be furnished with replaceable 3/8-inch, minimum, thick polyethylene wiper blade and wear strips bolted to two (2) structural pivot arms.

a. The arms shall be mounted on a minimum 1-inch diameter pivot shaft and supported by self-aligning ball bearings or sleeve bearings.

4. The entire wiper mechanism shall be located within the head section.

K. Bypass Discharge System:

1. The Bar Screen shall be provided with manually operated bypass chute to bypass the screenings material from the screw conveyor and discharge screenings into bypass containers.

2. The bypass containers shall be 55-Gallon Drums as shown on the Contract Drawings.

3. The drums shall be of HDPE construction and be provided with a removable top lid for screenings capture. The removable top lid shall be provided with a level lock ring constructed of galvanized steel with powder coated paint.

4. Each 55-Gallon drum shall be equipped with a lifting and dispensing hoist mount. The drum lifting and dispensing mount shall be Model 85i-SS as manufactured by L.K. Goodwin Co. or an approved equal.

5. The drum lifting and dispensing hoist mount shall be of stainless steel construction and shall be compatible with drum diameter adapters and bracket assemblies.

6. The drum lifting and dispensing hoist mount shall conform to ASME B30.20 standards for below-the-hook lifting devices.

L. Drive Unit:

1. The drive unit shall be of the motorized type mounted on an adjustable drive chain take-up based on the screen head section. The drive unit speed reducer shall be of the helical gear type, fully housed, running in oil, with anti-friction bearing throughout and close coupled to the motor. The gear reducer shall be Bauer, SEW-Eurodrive USA or approved equal.

2. Each motor shall be sized based on the requirements of the driven loads with consideration given to all drive train components. Electrical service for each shall comply with Section 26 05 60 – Low-Voltage Electric Motors.

   a. loading conditions (i.e., all rakes have a full design load of screenings in place at start-up).

   b. The motor shall be suitable for duty in a corrosive atmosphere and high shock loads complying with the applicable provisions of the stands of NEMA and IEEE.

3. The drive unit shall be assembled by the Manufacturer and shipped as a completed assembly to ensure proper assembly of all components.

4. The gear box and motor shall be provided with lifting eye for ease of maintenance.

5. The drive mechanism for the rakes shall incorporate a shaft constructed of stainless steel. The drive unit, including the reduction gearbox, shall be directly shaft-mounted and shall be positioned to facilitate maintenance work.

6. Gear box and the motor mating faces shall configuration readily available in the USA. Procuring European dimensioned equipment for the motor and gear box is not acceptable.

M. Screen Covers:

1. Front face of the screen shall have removable stainless steel cover and clear polycarbonate cover as shown on the Contract Drawings. The covers shall be provided with turn locks and handles. Screen cover shall be one sixteenth (1/16)-inch Type 316L with appropriate stiffeners.

2. Covers will be hinged or clamp-down designed to be readily removable to provide for easy maintenance and adequate to protect operating personal standing nearby.

3. Any removable cover piece shall not weigh more than forty (40) pounds. Each removal cover shall have lifting handles designed for convenient removal.

4. The contractor and the Manufacturer shall coordinate the cover locations with the walkway platform for screen access shown on the Contract Drawing.

    a. The coordination shall be provided so that any cover provide shall not interfere with the walkway support members. If required, segment(s) of cover may be eliminated along the walkway horizontal support frame.

5. The cover system shall be structurally capable of withstanding the full impact and wedging action of large debris that may be carried up the screen face and clogging that may occur in the drive sprocket return area without damage.

N. Anchor Bolts:

1. Equipment anchoring system shall be sized and designed by the equipment manufacturer and a complete information on anchor bolts size lengths embedment depth, epoxy material and any associated hardware shall be provided in the submittal.

2. Supply scope of the anchoring system items shall be coordinated between the Contractor and screening manufacturer.

3. Anchoring system shall be installed in accordance with the equipment manufacturer’s instructions.

4. Adhesive anchors meeting the requirements of Section 05 05 23 – Metal Fastening will be used for all anchoring to existing concrete. Anchoring must avoid existing reinforcing steel in accordance with Section 03 21 00 – Reinforcing Steel.

O. Controls:

1. General:

    a. Controls for each mechanical screen shall be furnished by the Screen manufacturer and shall include, but not limited to the vendor supplied Local Control Panel (LCP), programmable logic controller (PLC), operator interface terminal (OIT), Variable Frequency Drive (VFD), local control stations (LCSs), and instrumentation as required to provide a fully functional and complete system.

    b. The screen control system shall be furnished by the screen manufacturer completely pre-wired, programmed and tested, requiring only mounting and connection to external wiring in the field. It is anticipated that all mechanical screen control hardware and software will be identical from one to the next with the exception of equipment specific tagging and descriptions.

c. The overall Control Strategy shall be as shown on the Process and Instrumentation Diagrams (P&IDs) and as described in Section 40 61 96 – Process Control Descriptions. The controls and sequences described in Section 40 61 96 – Process Control Descriptions shall be taken as a general guideline of the required sequences and shall be modified and augmented by the mechanical screen vendor after submittal, review, and approval by the engineer. Additional control functions, interlocks, monitors, alarms, displays and trends as determined to be necessary for safe and reliable operation shall be provided at the manufacturer's discretion.

d. The vendor supplied PLC shall make provisions in both hardware and software for inputs and/or outputs to interface to the plant SCADA system as shown on the P&IDs and Section 40 63 43 Programmable Logic Controllers.

e. In addition to interface to the plant SCADA system, the vendor supplied PLC shall provide inputs/outputs as required to monitor and control downstream and associated equipment as required for overall system operation. The plant SCADA system shall provide monitor only facilities for operator information. For each type of hardwired input/output system, twenty-five percent spare input/output shall be provided to allow for future expansion of the PLC/SCADA interface.

f. To the extent practical, the colors, abbreviations, descriptions, layout, content and operator interface implemented by the OIT displays shall be coordinated and consistent with the existing facility standards and practices to provide a consistent operator interface with the remainder of the facility. The mechanical screen vendor shall provide preliminary sketches of the display layout, colors and conventions for review and approval.

g. At the conclusion of the project and acceptance for operation, the mechanical screen vendor shall provide fully documented and extensively commented PLC ladder logic programming and OIT graphic displays in their native formats for continued operation and maintenance of the systems. In addition, the vendor shall provide electronically printed documentation of the system for inclusion in plant archives and training materials.

h. Vendor supplied panels, panel devices, and construction shall conform to the requirements of the following Specification Sections:

    1) Section 40 67 00 – Control System Equipment Panels and Racks

    2) Section 40 78 00 – Panel Mounted Instruments

    3) Section 40 78 56 – Isolators, Intrinsically-Safe Barriers, and Surge Suppressors

2. Vendor Supplied Local Control Panel:

    a. Each screen shall be furnished with a Screen Vendor supplied LCP. The LCP shall be completely pre-wired and tested, requiring only mounting and connection to the interconnecting wiring in the field by the Contractor.

    b. The LCP shall have NEMA 4X rated enclosure installed in the Electrical Room as shown on the Contract Drawings. The LCP shall be provided with PLC, panel mount devices, and VFD.

    c. The LCP shall be constructed of type 304 stainless steel.

3. Variable Frequency Drive:

    a. The VFD shall be manufactured as by:

        1) Allen-Bradley,

        2) Or approved equal.

    b. General:

        1) The VFD shall be provided in the screen vendor supplied LCP for control of the screen drive system. The VFD shall be sized as required for the bar screen motor operation.

        2) The adjustable frequency controller shall be microprocessor-based, pulse width modulated design, suitable for operation on a low-voltage, 3 phase, 60 Hz supply.

        3) The controller shall produce an adjustable AC voltage/frequency output to vary the speed of the driven equipment and maintain the drive motor V/Hz rating.

        4) The controller shall consist of

            a) A power factor /harmonic filter unit

            b) 6 pulse, minimum, diode-bridge converter fed by rectifier-grade phase-shifting transformer.

            c) A fixed DC bus section

            d) A 3 percent DC bus reactor or input line reactor.

            e) An IGBT based power transistor inverter output section.

5) The controllers' solid state converter input section switching devices shall have a 1600-volt PIV rating.

6) The controller shall have an overload rating of 110 percent variable torque, 150 percent constant torque for one minute.

7) The VFD shall be sized to provide, indefinitely, motor load current equal to 125 percent of the screen motor’s direct on line (DOL) motor nameplate full load current and shall be suitable for use with constant torque loads.

8) RMS harmonic content of output current shall be less than 5 percent of fundamental current.

9) Controller shall be able to withstand output terminal line-to-line short circuits without component failure.

10) The controller shall have features in accordance with the following:

    a) Digital keypad and display module shall provide parameter setting, adjustments and monitoring of control functions and faults. Display messages shall be in English.

    b) Serial communication port shall allow connecting to a programmable logic controller interface.

    c) Independent acceleration/deceleration rates shall provide 2 to 600 seconds minimum. When called to stop, the motor shall decelerate to minimum speed before stopping.

    d) Power loss feature shall allow ride through capability.

    e) Time delay automatic restart shall allow restart after controller fault conditions with programmable attempts.

    f) Coasting motor restart shall permit the controller to restart into a coasting motor without damage or tripping.

    g) The coasting motor restart feature shall allow switching from bypass mode to VFD mode while operating without shutdown.

    h) Control inputs and outputs shall be isolated.

11) Protection and Logging of faults

    a) The controller shall have protective functions in accordance with the following:

b) Input line surge protective device shall provide transient protection.

c) Electronic over-current trip shall provide instantaneous and inverse time overload protection.

d) Over-temperature trip shall provide temperature protection.

e) Current limit trip shall provide current protection.

f) Input line over and under voltage trip shall provide voltage protection.

g) Ground fault trip shall provide ground protection.

12) Output Filter

a) An output filter shall be provided to prevent overstressing the motor insulation system.

b) An output filter shall be included for each VFD, whenever the cable length between the motor and VFD exceeds the following based upon the noted switching frequencies.

1 KHZ switching frequency, 200 feet cable length.

3 KHZ switching frequency, 175 feet cable length.

12 KHZ switching frequency, 100 feet cable length.

c) Output filters shall be provided in all other cases, based upon the recommendations of the VFD and motor manufacturers, whenever the actual voltage peaks at the motor terminals exceed the NEMA-MG1 limits.

d) The filter shall be three phase, low-voltage class motor-protecting type consisting of suitable values of inductance, capacitance, and resistance to form a damped, low pass filter.

e) The filter shall be a low-loss type specifically designed to reduce the voltage wave form dV/dT. The filter shall allow cable lengths at minimum exceeding the actual application distances with a waveform resulting in voltage spikes at the motor terminal which are within the NEMA-MG1-Part 31 voltage stress levels.

f) The filter shall be suitable for mounting within the VFD enclosure.

4. Local Control Stations:

    a. A local control station shall be provided for each screen located in the Bar Screen Room to allow operation from a position near the installed equipment.

    b. The LCS shall have NEMA type 7 enclosure.

    c. Each screen shall have an LCS rated for Class I, Division I, Group D.

    d. The LCS front mounted devices shall be as shown on the P&ID or as required for safe, reliable, and proper operation of the screen.

5. All conduit and cable required to power the motor shall be provided from the motor via a corrosion-resistant and explosion-proof cable tracking system to power conductor junction box by the screen Manufacturer.

6. Instrumentation:

    a. All instrumentation supplied shall be compatible with the electrical classification of the area where they are installed.

    b. Radar Level Transmitter – Two wire

        1) The screen manufacturer shall provide radar level transmitters for continuous monitoring of the upstream and downstream water levels for control of screen operation.

        2) Radar Level Transmitters shall be in accordance with Section 40 73 23.01 – Radar Level Transmitters – Two Wire.

    c. A high-water level float type switch shall be provided upstream in each bar screen channel in accordance with specification Section 40 72 76.26 – Level Switches (Floats).

2.03 FABRICATION / ASSEMBLING / FINISHES

A. Manufacturer shall confirm that welders and welding procedures are certified in accordance with AWS D1.6 – Structural Welding Code – Stainless Steel.

B. All stainless steel assemblies and subassemblies shall be acid passivated after welding for corrosion resistance and to provide a superior surface finish in accordance with the requirements of ASTM A-380. After passivation, the weldments will be thoroughly rinsed with clean water and allowed to air dry.

C. Where installation with height restrictions and/or shipping restrictions, the screen shall be supplied in flanged subassemblies such that the unit can be assembled and

disassembled. The flanged subassemblies shall be bolted together onsite during installation.

D. Side frames shall be designed to provide an unobstructed path for the rack cleaning mechanism.

E. Bars shall be one continuous section and shall be designed to provide an unobstructed path for the rack cleaning mechanism.

2.04 SOURCE QUALITY CONTROL / SHOP TESTS

A. Certified Shop Tests:

1. Shop testing shall be performed at the manufacturer's testing facility prior to shipment. Shop tests shall demonstrate that the equipment tested conforms to the requirements stated in this Section.

2. The manufacturer's testing facility shall be in the USA. Contractor shall notify the Engineer 30 days in advance of scheduled shop testing should the shop testing be done outside of USA.

3. The contractor shall provide shop test procedures for approval of the Engineer.

    a. Shop test procedures shall be submitted for Engineer's review at a minimum of 2 weeks before scheduled shop test.

    b. Shop test procedures shall identify the tests to be performed. The manufacturer shall respond to any questions raised by the Engineer and resubmit to the Engineer.

    c. No shop test shall be performed prior to approval of the shop test procedures.

4. The Manufacturer shall, through the contractor, provide shop test reports.

    a. The manufacturer shall provide a letter report certifying that the unit has passed the specified test and inspection requirements.

    b. The shop test report shall be submitted within 3 weeks of the shop test.

    c. Shop test reports shall identify the tests performed and the results obtained with a descriptive narrative indicate whether the equipment passed or failed.

    d. Failure to meet the requirements as specified in this Section shall be discussed along with steps to be taken by the Manufacturer that are necessary to correct any deficiencies. Manufacturer shall demonstrate

corrective steps taken to the Engineer and shall receive Engineer's approval before scheduling a re-testing.

1) Re-testing shall follow approved shop test procedures.

2) Re-testing shall be conducted at no additional cost to the Owner.

B. Screen Tests

1. Certified witness shop tests shall be as specified herein.

2. The following witnessed factory testing shall be provided for each screen and performed by the manufacturer at the manufacturers testing facility:

a. Each bar screen shall be factory assembled and tested complete, including job motor and gearbox.

b. A visual inspection of the unit to confirm Project requirements.

c. A no-load test run to confirm that no oil leaks, excessive lubricant temperature, excessive noise, and excessive vibration occur, and confirm the control operations.

d. Testing shall include a simulation of a fixed screen obstruction requiring the initiation of an auto-reverse sequence in accordance with the control strategy to clear the obstruction.

e. Run equipment and test for a minimum of two (2) hours.

f. Measurement of the no load motor current shall be performed.

g. Measurement of the output speed to verify gear ratio shall be performed.

h. Verify motor amperage and motor winding temperature.

i. Loading and Impact Tests:

1) Sandbags weighing two hundred (200) lbs shall be loaded on a stopped rake. The screen shall be started at low speed and the sandbags shall be transported from the lower portion (i.e., bottom sprocket elevation) of the screen to discharge elevation. This shall be completed for each screen three (3) times in succession without alarm.

2) A fifty (50) lb rigid object (e.g., a 1-foot diameter log) shall be dropped onto the screen field from a three (3) ft height (with the screen in the horizontal position) and distortion of the screen field shall be

measured. A successful test shall result in zero measurable distortion of the bars.

C. Control Tests:

1. Certified shop tests for controls shall be performed as specified in Section 40 61 13 – Process Control System General Provisions and Section 40 61 21 – Process Control System Testing.

2. Controls for each bar screen shall be pre-wired and tested complete including vendor supplied Local Control Panel and Local Control Station.

D. Inspection:

1. The entire assembly shall be visually inspected for any deformation prior to shipment.

PART 3 – EXECUTION

3.01 EXAMINATION / PREPARATION

A. In general, workmanship and finish of all metalwork shall be of the highest grade and equal to the best practice of modern shops. Exposed surfaces shall have a smooth finish and sharp, well-defined lines. Materials of construction where not specified herein shall be suitable for the service encountered, and as reviewed by the Engineer.

B. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the equipment is ready for continuous operation. Each component will be as fully assembled as transportation will allow. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer. Finished surfaces of all exposed openings shall be protected by wooden blanks, strongly built, and securely bolted thereto.

C. Finished iron or steel surfaces shall be painted per manufacturer’s recommendation. Each box or package shall be properly marked to show its net weight in addition to its contents. Care shall be taken to avoid supporting or lifting the screens in a manner that will place excessive stress on parts or shafts that are not designed to support the weight of the unit. The screens assembly shall be lifted by eyebolts provided in the frame. All appurtenances shall be handled and stored in accordance with the manufacturer’s recommendations and as specified herein.

3.02 INSTALLATION

A. Installation of equipment and materials provided under this Specification shall be in accordance with the manufacturer’s recommendations, the approved working drawings.

B. the general supervision of a factory-trained representative of the manufacturer. The equipment shall be checked, aligned, tested, and placed in operation by a factory-trained manufacturer's representative.

C. Equipment identification shall be in accordance with Section 40 05 97 – Piping and Equipment Identification Systems.

3.03 FIELD TESTING AND QUALITY CONTROL

A. After installation and prior to being placed in operation, each unit shall be inspected and checked by a qualified representative of the equipment manufacturer, as required. The following items will be verified:

1. Verification that all external system protective functions are functional and have been tested.

2. Verification that all internal protective functions are operational.

3. Verification that the screen discharge chute allows discharge to conveyor without spilling material onto the operating floor.

4. Review and verify that the specified control strategies, to ensure proper protection and operation of all components, systems, and interlocks.

5. Manufacturer’s recommendations for prestart preparation and preoperational checkout procedures.

    a. Contractor shall complete and submit screen manufacturer’s pre-startup checklist after Final Field Tests.

B. Make all adjustments to each unit as directed by the equipment manufacturer prior to placing the unit in operation. Each screen shall be checked by the manufacturer for lubrication, rotation, and the representative shall notify the Contractor and Engineer of anything in the installation which affects the manufacturer’s guarantee. The manufacturer’s representative shall provide certification that each screen is rotating in the right direction and is ready for testing.

C. Contractor shall conduct field acceptance test as specified herein, in the presence of Engineer.

D. Functional tests shall be coordinated with the Owner. Provide certification of test results. Tests and certifications shall be as specified in Section 01 75 00 – Checkout and Startup Procedures.

E. The contractor shall conduct field acceptance tests as specified herein, in the presence of the Engineer:

1. Preliminary Field Tests:

    a. The Contractor shall test the installed equipment at full speed for a minimum of four (4) hours. The test runs shall be undertaken with water in the channels filled up to the peak water elevations shown on the Contract Drawings. A successful test shall result in no excess running noise or vibration, or any faults conditions specified in this Section.

    b. Motor temperature shall be recorded at intervals of no greater than fifteen (15) minutes and shall not exceed the manufacturer's recommended maximum. Sound level shall be recorded and shall not exceed seventy-five (75) dBA at a distance of three (3) feet from the equipment.

2. Final Field Tests:

    a. Contractors shall operate each screen continuously for a minimum of 48 hours. Successful final fields tests shall result in no excess running noise or vibration, or motor over temperature.

3. Wet Weather Tests:

    a. Each screen shall be operated successfully for two (2) wet weather events. Contractor will cycle screens at the direction of the Owner to optimize operations during dry and wet weather events. Wet weather events shall have a plant flow of at least 40 MGD and plant flow shall sustain for the full duration of the wet weather test as specified below:

        1) The first installed screen shall operate under wet weather conditions continuously for 4 hours.

        2) Remaining two (2) screens shall operate under wet weather conditions continuously for 2 hours.

4. Control Tests:

    a. The controls and instruments for the mechanical bar screen shall be tested at the Local Control Stations, and Vendor Control Panels. The test shall be in accordance with Division 40 Process Interconnections. The control test shall include, but not be limited to:

        1) Testing of buttons, switches, and soft-switches at the Local Control Stations (Sacrificial), Local Control Stations, and Vendor Control Panel.

    b. Local and automatic mode as specified in this Section.

    c. Testing of all alarm conditions.

F. Provide a written certification from the equipment manufacturer that the equipment has been properly installed according to the plans, specifications, and manufacturer's specifications, and that the equipment is operating normally.

G. In the event of improper installation, correction of the Work and subsequent test runs will be provided until the defects are corrected at no additional cost to the Owner. Manufacturer will provide certification that the improper installation has been corrected.

3.04 STARTUP / DEMONSTRATION

A. As a part of the commissioning services, the Contractor shall provide on-the-job training and demonstration as specified herein.

B. The training shall include the following:

1. Screen theory
2. Equipment description
3. Operational and Controls information for the specific equipment provided under this Section.
4. Troubleshooting
5. Preventative Maintenance
6. Operation and Maintenance Manual orientation and layout
7. Disassembly and assembly
8. Demonstrate operations and controls at the local control panel and local control station.

3.05 MANUFACTURER'S REPRESENTATIVE

A. The Contractor shall provide the service of the manufacturer's representative to assist in the installation of equipment; check the installation before the equipment is placed into operation; assist in the start-up of the equipment; and train the plant operations and the maintenance staff in the care, operation, and maintenance of the equipment.

B. At a minimum, the services of the manufacturer's representative shall be provided as indicated herein below. The number of visits and person-days per visit indicated below shall be understood as referring to the minimum required services for the lot of equipment provided under this Section.

Occurrence	Duration
Installation	Three visit (3) of two (2) person-days per visit

Occurrence	Duration
Field Testing	Three visits (3) of two (2) person-days per visit
Start-Up	Three visits (3) of two (2) person-days per visit
Training	One visit (1) of one (2) person-days per visit

A. The Engineer reserves the right to require that any unused person-days from any visit be applied to any other specified visit.

B. Person-days shall be understood only as days spent onsite (not in transit).

C. The manufacturer's representative shall be a direct employee of the equipment manufacturer, with at least three (3) years' experience in the installation, testing, training, and start-up of equipment of the type provided under this Specification. The manufacturer's sales and marketing personnel will not be accepted as manufacturer's representatives.

D. The manufacturer's representative shall sign in and out at the office of the Engineer each day they are at the Site.

E. Reports: The Contractor shall submit a report from the manufacturer for each visit to the Site of the manufacturer's representative. The report shall provide complete information regarding the visit, including, but not limited to, dates, times, subject equipment, tasks performed, persons contacted, problems corrected, test results, training provided, and other pertinent information.

F. In addition to the above, the Contractor shall provide the services of person(s) authorized by the manufacturer to witness the unloading at the Site of the equipment provided under this Specification, and to ascertain the condition of said equipment. Manufacturers' sales and marketing personnel may be accepted as authorized person(s) to perform these specific tasks. The Contractor shall submit to the Engineer a report, completed by the authorized person(s), and certified by the equipment manufacturer, documenting the findings of the authorized person(s).

END OF SECTION

SCHEDULE 46 21 12 -1

NUMBER OF UNITS		1	1	1
DESCRIPTION		MECHANICAL BAR SCREEN	MECHANICAL BAR SCREEN	MECHANICAL BAR SCREEN
MECHANICAL SCREEN TAG NO.		MS-100	MS-200	MS-300
LCOAL CONTROL PANEL TAG NO.		LCP-100	LCP-200	LCP-300
LOCAL CONTROL STATION TAG NO.		LCS-100	LCS-200	LCS-300
CONDITION	CHANNEL WIDTH [a], FT	5’ – 10”	5’ – 10”	5’ – 10”
	CHANNEL INVERT ELEVATION [a], FT	52.5	52.5	52.5
	SCREEN OPERATING FLOOR, FT	70.5	70.5	70.5
	MAXMIUM FLOW RATE THROUGH SCREEN	40 MGD	40 MGD	40 MGD
	AVERAGE FLOW RATE THROUGH SCREEN	10.3 MGD	10.3 MGD	10.3 MGD
	MINIMUM FLOW RATE THROUGH SCREEN	5.8 MGD	5.8 MGD	5.8 MGD
SCREEN	MAXIMUM WATER DIFFERENTIAL	10’-0”	10’-0”	10’-0”
	MINIMUM SCREEN BAR RACK HEIGHT, FT	8’-0”	8’-0”	8’-0”
	DOWNSTREAM WATER DEPTH AT PEAK FLOW	4’-9”	4’-9”	4’-9”
	MAXIMUM BAR SPACING	3/8”	3/8”	3/8”
	MAXIMUM ALLOWABLE HEADLOSS, CLEAN SCREEN	0’-2”	0’-2”	0’-2”
	MAXIMUM ALLOWABLE HEADLOSS, 30% BLIND	0’-6”	0’-6”	0’-6”
	SCREEN INCLINE FROM HORIZONTAL [b]	80	80	80
	SCREENINGS REMOVAL CAPACITY PER SCREEN, CF/HR	70	70	70
MOTOR	MAX MOTOR HORSEPOWER, HP	5	5	5
	ENCLOSURE TYPE	XP-TEFC	XP-TEFC	XP-TEFC
	RPM	1750	1750	1750
	VOLTAGE	480	480	480
	PHASE	3	3	3

[a] Contractor shall field verify exact channel invert elevation and channel width.

[b] Contractor shall coordinate exact incline with final field conditions. Electrical equipment within the enclosed area (including motor, radar sensor), shall be rated for Class 1 Division 1 area classification. Electrical equipment outside the enclosed area (control panels, level transmitter, and electrical panels) shall be rated for area classifications as indicated in the Contract Drawings.

NO TEXT ON THIS PAGE

SECTION 46 21 73
SCREENINGS WASHER – COMPACTORS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. This Section specifies screenings washer-compactors complete with drive assembly, supports, controls, field instruments, wiring, piping and valves, special tools, spare parts, accessories, and other appurtenances as specified and as required for a complete and operating installation.

B. The Contractor shall furnish, install, test, and place in satisfactory operation, screenings compactors complete with all necessary accessories specified herein and as shown on the Contract Drawings.

C. Equipment shall be provided in accordance with the requirements of Section 46 00 00 – Equipment General Provisions.

D. The Contractor shall coordinate the Work of this Specification with the bar screens as specified in Section 46 21 12 – Mechanically Cleaned Multi-Rake Type Bar Screens and the screw conveyor as specified in Section 46 76 42 – Screw Conveyors.

E. It shall be the Contractor's responsibility to ensure that the mechanical screen and screenings washer-compactors and appurtenances furnished and installed shall be compatible and have the necessary operating clearances with the structural elements and equipment shown on the Contract Drawings.

F. Layout, dimensions, and elevations shown on the Drawings are representative of the screenings washer-compactors. Any costs for re-design, materials, or construction due to requirements of the screenings washer-compactor equipment ultimately furnished shall be the responsibility of the Contractor.

G. Related Sections:

1. Section 03 21 00 – Reinforcing Steel
2. Section 26 05 60 – Low-Voltage Electric Motors
3. Section 40 05 68.23 – Miscellaneous Valves
4. Section 40 05 97 – Piping and Equipment Identification Systems
5. Section 40 61 96 – Process Control Descriptions
6. Section 40 67 00 – Control System Equipment Panels and Racks
7. Section 40 78 00 – Panel Mounted Instruments

8. Section 40 78 56 – Isolators, Intrinsically-Safe Barriers, and Surge Suppressors

9. Section 46 00 00 – Equipment General Provisions

10. Section 46 21 12 – Mechanically Cleaned Multi-Rake Type Bar Screens

11. Section 46 76 42 – Screw Conveyors

1.02 OPERATING CONDITIONS AND PERFORMANCE REQUIREMENTS

A. The screenings washer-compactors shall be designed for reduction of organic content, moisture, and volume from screenings material removed from the incoming wastewater flow by mechanical screens.

B. The heavy-duty screw type screenings compactor shall be suitable for installation and operation with the screw conveyor and shall accept screenings from screw conveyor, compress and dewater them and deliver them to the screenings storage container as shown on the Contract Drawings.

Screenings Wash-Compactors

Area	Compactor Room
Quantity	1
Tag	COMP-500
Capacity	140 cfh
Screenings Volume Reduction, %	50%
Compacted Screenings Discharge, % dry solids	35%
Minimum Screw Diameter	14.5”
Minimum Shaft Diameter	3”
Maximum Screw Rotational Speed	14 rpm
Discharge Height above Operating floor (Compactor Discharge Pipe Invert.)	See Contract Drawings

1.03 SUBMITTALS

A. The following items shall be submitted in accordance with, or in addition to the submittal requirements specified in Section 01 33 00 – Submittal Procedures and Section 46 00 00 – Equipment General Provisions.

B. The Contractor shall submit the following:

1. Working Drawings (see additional information below)

2. Operation and Maintenance Manuals

3. Training Lesson Plans

4. Lists of Spare Parts, Special Tools, and Supplies

5. Table of recommended lubricants with contact information and addresses for lubricant suppliers.

6. Shop Testing Plan (including description of testing arrangement), Field Testing and Startup Plan, Training Lesson Plan

7. Reports of Certified Shop Tests

8. Manufacturer Startup Checklist

9. Reports of Field Tests, Startup and Startup Checklist

10. Lists of Manufacturer's Service Facilities

11. Reports of Manufacturer's Representative Site Visits

C. Working Drawings shall include, but not be limited to, the following:

1. Manufacturer experience and listing of successful operation in other facilities of equipment similar to that proposed for this Project, as specified herein and Division 1 – General Requirements.

2. Certification of manufacturing facility, ISO 9001, or similar quality control protocols.

3. A copy of this Specification Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements or those parts which are to be provided by the Contractor or others. Check marks shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up Specification Sections, along with justification(s) for any requested deviations to the specification requirements shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

4. A copy of the Contract Document control diagrams and process and instrumentation diagrams, electrical drawings with addenda updates, that apply to the equipment in this Section marked to show specific changes necessary for the

supplied equipment. If no changes are required, the working drawing shall be marked "No Changes Required."

5. Manufacturer’s equipment specifications and data sheets, which shall include but not be limited to the following information:

    a. Parts list with materials of construction and methods of fabrication.

    b. Weights of equipment component parts, assembled weight of equipment, and total shipping weight. As applicable, include dynamic loads and weight when full and all loads transmitted to supporting structure.

    c. Product data sheets for all components.

    d. Equipment heat tracing and insulation details.

    e. Design performance data including but not limited to: capacity, volume reduction, discharge dry solid contents.

    f. External utility requirements for power for each component.

6. Complete assembly, layout, installation, and shop drawings, with clearly marked dimensions, and details. Details shall include but not limited to the following information:

    a. Detailed structural, mechanical, and electrical drawings showing equipment fabrications and interface/ connections with other items or Work:

    b. Details of the motor, gear reducer, and lubrication points

    c. Equipment cross-section drawings.

    d. Anchorage.

    e. Anchoring plan will include information on plan to avoid cutting reinforcing steel in accordance with Section 03 21 00 – Reinforcing Steel.

7. The following calculations shall be submitted:

    a. Compactor Screening’s Capacity calculations.

    b. Bearing life calculations per AFBMA standards.

8. Certification of welders, steamfitters, and other workforces.

9. Painting and coating details.

10. Equipment nameplate data.

11. Manufacturer's delivery, storage, and handling requirements.

12. Detailed Manufacturer's installation instructions and recommendations, including installation requirements requiring coordination with Contractor and/or other equipment suppliers.

13. Motor data as specified in Section 26 05 60 – Low-Voltage Electric Motors.

14. Control component data as specified in Division 40 – Process Interconnections.

15. Testing and adjusting instructions.

16. Submit location of the nearest permanent service headquarters of the compactor and motor manufacturer for the compactor and motor submitted.

17. Equipment warranty information.

D. Operation and Maintenance Manuals

1. The Contractor shall submit operation and maintenance manuals in accordance with the procedures and requirements set forth in Section 01 78 23 – Operations and Maintenance Data.

E. Training Lesson Plans

1. The Contractor shall submit Training Lesson Plans in accordance with the procedures and requirements set forth in Section 01 79 00 – Instruction of Owner's Personnel.

1.04 QUALITY ASSURANCE

A. Manufacturer shall be successful in the experience of manufacture, operation, and servicing of equipment of type, size, quality, performance, and reliability equal to that specified. The manufacturer shall have furnished equipment of the size and type specified which has been in successful operation for not less than 5 years.

B. Manufacturer shall have established an ISO 9001 certified quality management system. Equipment supplier shall provide evidence of certification.

1.05 WARRANTY AND GUARANTEE

A. Warranty and Guarantee shall be as specified in Section 46 00 00 – Equipment General Provisions with the exception that the warranty period shall be for one (1) year from Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall deliver, store, and handle the equipment and materials provided under this Specification in accordance with manufacturer's instruction and as specified in Section 01 65 00 – Product Delivery Requirements, and Section 01 66 00 – Product Storage and Protection Requirements.

PART 2 – EQUIPMENT

2.01 MANUFACTURERS

A. Materials/Equipment specified under this Section shall be as manufactured by:

1. Headworks International
2. Huber Technology
3. Vulcan Industries
4. Or approved equal

B. The Contractor shall supply products modified as necessary by the manufacturer to provide the specified features and to meet the specified operating conditions.

C. The compactors, controls, and all standard equipment shall be provided by a compactor manufacturer who shall take full responsibility for the system.

2.02 SCREENINGS COMPACTOR

A. General

1. The screenings compactor shall consist of a screw housing, a gear drive unit, discharge pipe, and drain connections. Unless specified otherwise hereinafter, stainless steel shall be ASTM A-240 Type 316.
2. The equipment shall undergo a passivation process to ensure maximum resistance to corrosion.
3. The screenings compactor shall be capable of continuous operation and of handling all wash water flow and screenings conveyed from the screen. The screenings compactor shall be able to start and stop numerous times without damage to the motor. Manufacturer shall provide calculations to show the screenings compactor is sufficiently sized to convey the maximum amount of screenings and wash water that the screening equipment can deliver. The excess liquid shall drain through holes in the inlet trough.

4. The screenings compactor shall have a transport zone, wash zone, and compaction zone.

B. Screw and Shaft

1. Conveyance shall be by means of a helical screw constructed of 316 SS (ASTM 240) flights welded to a 316 SS (ASTM 276) solid shaft. All flights shall have a minimum thickness of ½-inch. Alternately, the screw shall be constructed of alloy steel flights welded to a hollow shaft having a minimum Brinell hardness of 200 and hard facing applied to the end of the screw to extend useful service life. All flights shall have a minimum thickness of 3/4-inch.

2. The screw shall be supported at the drive end by an independent thrust and radial load bearing or by a spherical roller thrust bearing which is installed in a grease packed housing fitted with lip seals to prevent the ingress of moisture.

3. Hard wearing nylon brushes shall be fitted to the flights of the screw to prevent material blocking the perforated trough. The brushes shall be fixed to the screw with adjustable clamps or set screws.

C. Screw Housing

1. The screw shall run within the U-shaped trough that forms the base of the hopper. The 316L stainless steel trough shall have punched perforated holes of the same diameter as the mechanical screen or a ½-inch thick wedge wire section constructed of individual profiled bars to allow drainage of the excess water back into the channel.

2. The reject water trough shall be made of 316 SS. The reject water trough shall be provided with a 6-inch minimum diameter flanged drain pipe connection. Flushing connections shall be provided at each end of the drainage collection trough to allow washing/cleaning of trough, and also to prevent over-accumulation of compacted screenings material into the drainage slots.

3. Connections for washwater to wash organic solids into a drain to return to the plant process shall be provided by the Screenings Compactor manufacturer. Screenings Compactor manufacturer shall provide all necessary motorized ball valves, strainers, and isolation valves.

4. The screw shall convey the screenings into a tapered compaction cone that shall be the dewatering zone.

D. Plant Water Manifold:

1. The screenings washer-compactor shall be equipped with a manifold to provide plant water to the different washing inlet locations.

a. The screenings washer shall be provided with no less than two (2) sperate connections for injecting wash water into the screenings and one (1) connection to the drain pan underneath the compactor body.

b. Manifold shall have one (1) isolation ball valve.

2. The unit shall be designed to accept wash water from the facility's non-potable water system, sourced from the final plant effluent. Contractor shall provide strainer with a mesh size 40. Strainer shall be in accordance with Section 40 05 68.23 – Miscellaneous Valves. Wash water connections shall be sized and positioned by the unit manufacturer. The maximum water consumption for the washer body shall be 16 gallons per minute (gpm). The water pressure range required at the connection to the unit for proper unit operation shall be 30 – 60 psi. Contractor shall provide pressure regulator (pressure reducing valve) when main wash water supply pressure exceeded the maximum allowable pressure. Pressure reducing valve shall be in accordance with Section 40 05 68.23 – Miscellaneous Valves.

3. The main water supply line to the compactor shall be provided with two (2) solenoid valves. Solenoid valve shall be in accordance with Section 40 05 68.23 – Miscellaneous Valves.

a. One solenoid valve shall supply wash water directed against the rotation of the screw flights in the inlet hopper, and into the compaction zone of the compactor.

b. The second solenoid valve shall direct wash water to the drain pan beneath the screenings washer body.

E. Drive Unit

1. The screw shall be powered by a helical gear reducer and motor, shaft mounted via a torque arm to a bracket fitted on the main compactor body or a double reduction worm gear unit, having a hollow shaft drive fitted with a flanged-mounted motor.

2. The bearing shall be immersed in oil and have an AFBMA B-10 bearing life of 100,000 hours minimum.

F. Discharge Pipe

1. The solids discharge zone shall consist of a 316 stainless steel pipe extension flanged to the outlet of the compactor to extend dewatering time and enhance frictional dewatering forces.

2. The pipe extension shall be inclined at 45° or 90° and have an outside diameter slightly larger than that of the compactor outlet. Pipe diameter shall not exceed 24".

3. The dewatered solids discharge pipe shall discharge horizontally into a screenings container as shown on the Contract Drawings. The orientation and dimensions of the discharge line shall be as shown on the Contract Drawings.

G. Supports

1. Rear leg, front leg and intermediate leg supports, as required, shall be furnished for rigid support to the concrete slab.

2. Screenings Compactors shall have 316 SS casters such that it can be removed from mechanical screen discharge for maintenance.

2.03 ELECTRICAL AND CONTROL REQUIREMENTS

A. All motors and all necessary items integral to the screenings compactors required for proper compactor operation shall be furnished and installed under Division 46 of the Specifications ready for the electrical connections to be made under Division 26 of the Specifications. The Contractor shall coordinate screen and screenings compactor controls with the requirements of Section 40 61 96 – Process Control Descriptions.

B. Controls for the screening compactor shall be furnished by the screening compactor manufacturer. Controls shall be as shown on the Contract Drawings and as specified in Division 40 – Process Interconnections.

1. Control panels shall be completely pre-wired, and tested, requiring only mounting and connection to the interconnecting wiring in the field by the Contractor.

2. Control panels shall have NEMA enclosures suitable for the electrical classification where they are installed as shown on Drawings.

3. Control panels shall provide interface to external devices and the existing plant SCADA RTU-1 PLC using dry contacts and 24vdc relays.

4. Vendor supplied panels, panel devices, and construction shall conform to the requirements of the following Specification Sections:

a. Section 40 67 00 – Control System Equipment Panels and Racks

b. Section 40 78 00 – Panel Mounted Instruments

c. Section 40 78 56 – Isolators, Intrinsically-Safe Barriers, and Surge Suppressors

C. All conduit, couplings, fittings, and fasteners furnished by the equipment manufacturer shall be PVC coated rigid galvanized steel and liquid tight, PVC coated, flexible metal conduit.

1. Provide 20 feet of flexible cable and metal conduit to allow Screenings Compactor to be moved from Mechanical Screen Discharge location for maintenance.

D. Electrical Requirements

Motors	Screenings Compactor
Rating	460V, 3 ph, 60 Hz
Horsepower (Maximum)	10
Speed, rpm	1800
Enclosure	TEFC XP
Insulation	Class F
Inverter Duty	No
Service Factor	1.15
Space Heater	Yes
Motor Winding Temperature Switches	Yes

E. A power monitor shall be provided to detect high motor current due to excessive loads.

1. The unit shall be suitable for 115 VAC, single-phase current with a manual reset.

2. The unit shall be suitable for Class 1, Division 1, Group D service. The unit shall be mounted in a NEMA 7 enclosure.

3. The unit shall be furnished with normally open contacts which close when overcurrent is detected. Contacts shall be rated for 5A (minimum) at 120 VAC.

4. The unit shall be furnished with a current transformer (CT). The secondary of the CT shall be wired as an input to the unit.

2.04 SPARE PARTS

A. The Contractor shall furnish all special tools (one set per like piece of equipment) necessary to disassemble, service, repair and adjust the equipment.

B. The Contractor shall furnish spare parts as recommended by the equipment manufacturers in addition to those listed below.

C. Spare parts shall be provided in accordance with Section 46 00 00 – Equipment General Provisions for this Contract shall include the following:

Spare Parts	
1	**Drive unit as specified**
1	**Brush**
1	**Motorized solenoid valve**

One year supply of all recommended lubricants

2.05 SHOP TESTING

A. Shop testing shall be in accordance with Section 46 00 00 – Equipment General Provisions.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Installation of equipment and materials provided under this Specification shall be in accordance with the manufacturer's recommendations, the approved working drawings, and the requirements specified in Section 46 00 00 – Equipment General Provisions.

B. The Contractor shall ensure that the screening compactors and appurtenances furnished and installed shall have the necessary operating clearances needed based on the manufacturer's requirements.

3.02 FIELD TESTING

A. Field Testing shall be performed in accordance with Division 01 and Section 46 00 00 – Equipment General Provisions

B. After installation and prior to being placed in operation, each unit shall be inspected and checked by a qualified representative of the equipment manufacturer, as required. The following items will be verified:

1. Verification that the screening receiving inlet allow discharge from mechanical screen without spilling material onto the operating floor.

2. Review and verify that the specified control strategies, to ensure proper protection and operation of all components, systems, and interlocks.

3. Manufacturer's recommendations for prestart preparation and preoperational checkout procedures.

C. The screening compactors shall be field tested after erection in the presence of the Owner and Engineer to confirm and verify the structural and mechanical compliance to the specification.

1. The field acceptance test shall include demonstrating that the washing press operates without vibration, jamming or overheating and perform its specified function satisfactorily.

D. Provide a written certification from the equipment manufacturer that the equipment has been properly installed according to the plans, Specifications and manufacturer's specifications, and that the equipment is operating normally.

E. In the event of improper installation, correction of the Work and subsequent test runs will be provided until the defects are corrected at no additional cost to the Owner. Manufacturer will provide certification that the improper installation has been corrected.

3.03 STARTUP / DEMONSTRATION

A. As a part of the commissioning services, the Contractor shall provide on-the-job training and demonstration as specified herein and conforming to the requirements of Section 01 79 00 – Instruction of Owner's Personnel.

1. Any downtime or unexpected shutdown shall not be allowed during contractor startup service.

B. Training shall include the following:

1. Equipment description

2. Operational and Controls information for the specific equipment provided under this Section

3. Troubleshooting

4. Operation and Maintenance Manual orientation and layout

5. Routine maintenance

6. Equipment calibration

7. Disassembly and assembly

8. Demonstrate operations and controls at control panel shall be in accordance with Division 40.

3.04 MANUFACTURER'S FIELD SERVICES

A. The services of a qualified manufacturer's technical representative shall be provided in accordance with Section 46 00 00 – Equipment General Provisions, and shall include the following site visits:

Service	Number of Trips	Number of Days/Trip
Installation and Testing	2	2
Startup	2	1
Training	2	2
Services after Startup	1	1

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 46 76 42
SCREW CONVEYORS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. The Contractor shall furnish, install, test and place in satisfactory operation a screw conveyor system, including conveyors, slide gates, interconnecting chutes, supports, and other ancillary equipment required for a fully functional system. The screw conveyor system shall transport mechanically screening material removed from incoming wastewater by mechanical screens to the screenings washer-compactor.

B. The screw conveyors system shall be provided by a single manufacturer, complete with all necessary components, drives, motors, instrumentation, controls, ancillary items and supports.

C. The design of the screenings conveying system shall be based upon the Contract Drawings, these Specifications and the manufacturer's experience with at least five (5) existing systems of similar sizes, capacities, and handling material with similar characteristics. These systems shall have been operating for a minimum of five (5) years.

D. The Contractor shall coordinate Work of this specification with the bar screens as specified in Section 46 21 12 – Mechanically Cleaned Multi-Rake Type Bar Screens and the screenings washer-compactor as specified in Section 46 21 73 – Screenings Washer-Compactor.

E. The Contract Drawings and this Section provide equipment descriptions, minimum requirements, and mandatory features of the equipment to be furnished. It is the Manufacturer's responsibility to design and furnish the equipment complete in all details, performance, and reliability meeting the requirements and intent of the Contract Drawings and these Specifications.

F. The equipment shall be furnished complete with all accessories, special tools, spare parts, base attachments, mounting anchor bolts, and other appurtenances as specified herein or as may be required for a satisfactory installation.

G. Related Sections:

1. Section 26 05 60 – Low-Voltage Electric Motors
2. Section 40 05 58 – Gate Operators and Electric Gate Actuators
3. Section 46 00 00 – Equipment General Provisions
4. Section 46 21 12 – Mechanically Cleaned Multi-Rake Type Bar Screens

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5. Section 46 21 73- Screenings Washer-Compactor

1.02 CONDITIONS OF SERVICE AND DESIGN PARAMETERS

A. The conveyors shall be capable of operation for the conditions of service described herein.

1. Screening Screw Conveyors

a. The removed screenings are indeterminate. For the purpose of design, the following conditions of service shall be assumed.

Material	Wastewater screenings
Max Bulk Density	70 pounds per cubic foot
Solids Content	20% (by weight)
Temperature	100°F (maximum) 40°F (minimum)

B. The conveyors shall be provided to meet the following design parameters.

Conveyor Designation	**SC-01**
Volumetric Capacity, cubic ft/hour	310
Mass Capacity, lbs/hour	20,000
Diameter, inches (Minimum)	14
Nominal Length	39’0”
Conveyor Style	Shaftless
Design Bed Loading Factor	30%
Inclination / Slope	8° (Inclined)
Screw Pitch	Full
Rotating Speed, rpm	< 20
Maximum Trough Length, feet	39’
Pressure Relief Cover(s)	No
Special Requirements (See notes below)	1, 2

1. Provide conveyor inlet connections to match mechanically cleaned multi-rake type bar screens discharge chute.

2. Provide conveyor with minimum 3” diameter drain outlet for connection to drain piping.

1.03 SUBMITTALS

A. The following items shall be submitted with the Shop Drawings in accordance with, or in addition to the submittal requirements specified in Section 01 33 00 – Submittal Procedures and Section 46 00 00 – Equipment General Provisions.

1.04 QUALITY ASSURANCE

A. All supports for conveyors shall be provided for the conveyor support framing. The Contractor shall be responsible for coordinating the placement of all supports necessary to tie the equipment together and shall have the undivided responsibility for the system's structural integrity.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. The screw conveyors shall be manufactured by

1. SPIRAC (USA) INC.

2. Jim Meyers and Sons

3. JDV Equipment,

4. Or approved equal.

2.02 GENERAL REQUIREMENTS

A. These specifications shall be considered as minimum requirements. The Contractor or Equipment Supplier shall add such additional features as are necessary for satisfactory operation and functioning of the conveying equipment.

B. Equipment shall conform to Section 46 00 00 – Equipment General Provisions unless modified herein.

C. Equipment provided shall be suitable for a humid and corrosive environment.

D. Structural design shall be in accordance with American Institute of Steel Construction AISC Standards.

E. All materials and construction shall be ASTM A276 Type 304 stainless steel unless otherwise specified. All gaskets shall be neoprene.

F. Stainless steel shall be shop brush blasted to remove heat tint scale and provide a uniform finish.

G. Material thicknesses and dimensions shall conform to the following minimum requirements unless otherwise specified or required for structural considerations.

Trough Bodies	1/4-inch
Trough Top Flanges	1/4-inch
Trough Top Covers	1/8-inch
Trough End Flanges	1/4-inch
Trough End Plates	1/2-inch
Trough Discharge Chutes/Spouts	3/16-inch
Internal Stiffeners	1/4-inch
Internal Shrouds	3/8-inch
Supports – Welded to Body	1/2-inch
Supports – Saddle Type	1/4-inch
Gaskets (Durometer 50)	1/16-inch (covers) and 1/8-inch (all others)

2.03 TROUGHS, COVERS, END PLATES AND CHUTES

A. Conveyor Troughs

1. Conveyor trough bodies shall be “U” type with trough dimensions conforming to the requirements of CEMA Standard 300, with exceptions as noted herein. The conveyor trough bodies shall be rolled to shape with the double formed top flanges formed with, or welded to, the trough body. Trough end flanges, welded to each trough section, shall be provided for joining adjacent sections or connecting trough end plates to the trough sections.

2. Individual trough segment lengths, measured from end flange to end flange shall not exceed the lengths given in the conveyor schedule for each conveyor. Conveyors with lengths greater than the maximum individual trough segment length shall be constructed of two or more sections bolted together at the trough end joining flanges.

3. Each shaftless screw conveyor trough shall be equipped with minimum 3-inch diameter NPT drain nipples located at the drive and tail trough ends. The drain

nipple(s) shall extend three inches below the screw conveyor trough and be supplied with a threaded cap.

4. Conveyor troughs for shaftless screw conveyors shall be equipped with a wear liner across the entire inside length. The wear liner shall be fabricated of 1/2-inch thick (minimum) high density UHMW polyethylene with sintered wear resistant filler and synthetic lubricant. The wear liner shall be provided in 4-foot-long sections (maximum length) for ease of replacement. The wear liner shall be held in place using stainless steel clips welded or bolted to the inside of the trough. Clips and bolts shall be placed away from the conveyor spiral path.

5. Conveyor troughs for shaftless screw conveyors shall be furnished with anti-floatation devices. The anti-floatation devices shall be fabricated of HDPE flat bars with a minimum thickness of 3/8-inch and a minimum width of 2-inches. The anti-floatation device bar shall run the entire length of the screw conveyor and shall be located above the screw on both sides of the trough. The bars shall be supported by stainless steel brackets attached to the trough cover flange every two feet.

B. Conveyor Covers

1. A sectional stainless-steel plate shall cover the entire trough, with the exception of where the inlet chute connections are located. Cover segments at inlet chute connections shall extend, on each side, beyond the inlet chute connection and shall be bolted in place. Each cover section shall be not greater than 6-feet in length. The cover segments shall be arranged so that the trough flange and a trough stiffener provide support to each edge.

2. The covers shall open for maintenance and cleaning purposes. The cover shall be furnished with a toggle-clamp type, or spring clip type, quick release connections on each side of the cover. The quick release connectors shall remain attached to the conveyor trough when the cover is removed.

3. Gaskets shall be installed along each trough cover flange and each stiffener to ensure a drip proof connection and minimize air leakage through the conveyor cover.

4. Pressure relief covers shall be provided at conveyor discharge ends when required by the conveyor schedule and shall expose the full width of the conveyor trough when opened. Pressure relief covers shall be designed to open upon build-up and packing of material at the discharge endpoint. Pressure relief covers shall be supplied with safety limit switches as described elsewhere in this Section.

C. Conveyor End Plates

1. End plates shall be fabricated from stainless steel plate and shall be bolted and gasketed to the trough end flange. End plates shall be designed to support the drives, bearings, and gear reduction assembly.

2. The end plate assembly shall be supported independently of the conveyor troughs. Support points for the drive and tail end assemblies shall be welded to the end plates.

3. Where shafts penetrate the end plates the end plate shall be provided to accommodate the stuffing box.

D. Conveyor Chutes

1. Trough inlet and discharge chutes shall be bolted to the adjoining equipment as shown on the Contract Drawings. Inlet and discharge chutes shall be supplied with reinforced rectangular or circular flanges.

2. Trough inlet chute connection flanges shall be located approximately 3-inches above the top of the conveyor trough. Trough discharge chute connection flanges shall be located approximately 3-inches below the bottom of the conveyor trough.

3. The Conveyor Equipment Supplier shall furnish connection chutes and transition pieces between the conveyors and related equipment. Chute connections and transition pieces with length greater than 2-feet between flanges shall include at least four handles to facilitate removal of the connection chute. Handles shall be fabricated from 1/2-inch diameter rod of the same material as the chute, formed and welded to the sides of the chute.

4. Where shown on the drawings, conveyor equipment supplier shall furnish flexible discharge chutes fabricated from heavy duty rubber resistant to deterioration from contact with wet screenings or outdoor exposure.

5. Full-face gaskets shall be provided between each flanged inlet, discharge, connection, and transition chute.

2.04 CONVEYOR DRIVE TRAIN EQUIPMENT

A. The conveyor drive train equipment shall transmit power to the conveyor drive shaft using a shaft mounted speed reducer directly connected to an electric motor.

B. Drive Shaft Assembly

1. The drive end assembly shall consist of the following components.

a. Drive Shaft

b. Packing Gland/Stuffing Box

c. Hollow Shaft Gear Reducer

d. Bearing and Housing

e. Drive Motor

2. Only a drive end assembly shall be provided for shaftless screw conveyors. Both drive end and tail end assemblies shall be provided for shafted screw conveyors.

3. Drive shafts for the shaftless screw conveyors are to be complete with mating connections appropriate for mating to the shaftless screw assembly. The drive and tail shafts shall be of adequate diameter to handle all radial, thrust and torsion loads. The drive and tail end shafts shall be mounted to the shafted rotor or shaftless spiral by a flanged connection.

4. An adjustable packing gland seal shall be provided where shafts project through the conveyor end plate. Packing glands shall be provided with not less than five packing rings per stuffing box. Packing shall be grease lubricated. Grease fitting(s) shall be provided to lubricate the packing rings.

C. Drive Motor

1. Drive motors shall conform to the applicable requirements of Section 26 05 60 – Low-Voltage Electric Motors.

2. Drive motors shall be suitable for continuous severe duty service.

D. Speed Reducer

1. The speed reducer shall be a direct driven, enclosed shaft mount type unit. The speed reducer shall mount directly on the driven shaft. All gears shall be AGMA Class II, single or double reduction, helical gear units with high-capacity roller bearings. The reducer will be the standard air-cooled unit with no auxiliary cooling.

2. The speed reducer housing shall be constructed of ductile, iron and shall be ribbed for added strength.

3. The speed reducer bearings shall be ball or tapered roller type and provide a 50,000-hour L-10 life at the expected design loading rate. All seals shall be double lip, spring-loaded type and made of nitrile rubber.

4. Speed reducer gears and bearings shall be splash lubricated using petroleum-based oil, containing anti-foam and rust inhibiting additives. Speed reducer installation shall be accomplished by using ductile iron, fully split, twin tapered bushings keyed to the shaft. Reducer removal shall be accomplished by providing jack screw holes in the bushing flanges to mechanically remove the tapered assembly.

5. The speed reducer shall be manufactured to Quality Class 8 per AGMA Standard 6001-C88, minimum. The gear reducer shall be selected for AGMA Class 11 service with a 1.4 service factor based on motor nameplate horsepower.

6. The speed reducer shall be as manufactured by SEW Eurodrive, Inc., Nord Gear Corp., or approved equal.

2.05 CONVEYOR SUPPORTS

A. The conveyor troughs shall be supported using saddle type supports shaped to the profile of the troughs and extending to a common fixed distance below the centerline of the screw. Saddle type supports shall be located not greater than 10-feet center-to-center. Separate support points shall be provided under the drive end and tail end assemblies. These supports are to be welded as an integral part of these assemblies.

B. Stiffeners shall be placed across the top of the trough and fastened on both sides. Stiffeners shall be designed to maintain the trough shape under loading and shall also act as a face seal for the covers. Stiffeners shall be located so as not to impede the removal of maximum screw lengths as listed herein.

C. Support loadings are to be based on a completely filled trough, weight of the conveyor and the dynamic loading when operating.

D. The Contractor shall coordinate with the Conveyor Equipment Supplier support locations with the facility structural constraints. Access to other process systems and equipment shall not be restricted by the conveyor supports.

E. Each conveyor shall be field shimmed as required to conform to the manufacturer's installation tolerances.

F. Supports shall be constructed of ASTM A-36 structural steel shapes. Support members shall be hot dip galvanized coated to a minimum 3-4 mils DFT per ASTM A123.

2.06 SHAFTLESS SCREW ASSEMBLIES

A. The shaftless screw flights shall be cold rolled spirals fabricated from high strength carbon spring steel bars with a minimum tensile strength of 87,000 psi and a minimum Brinnel hardness of 220. Screw assemblies shall be provided with a dual spiral. Outer spiral flights shall have a minimum thickness of 1-inch and a minimum width of 2-3/4 inches. Inner spiral flights shall have a minimum thickness of 5/8-inch and a minimum width of 1-1/2 inches.

B. The manufacturer shall demonstrate that the drive unit cannot produce enough torque, at 250 percent of the motor nameplate horsepower, to exceed the torsional rating of the shaftless spiral. The spiral deflection shall not exceed 0.010 inches per foot of length at the maximum loading condition.

C. Shaftless screw conveyor spiral flights shall be formed in a forming machine to the diameter and pitch required. Spirals shall be concentric to ± 0.080-inch maximum. Each formed section shall be factory welded into full lengths. Where the length of the conveyor

precludes shipping, sub-sections of flighting shall be divided into maximum shipping lengths and welded together in the field.

D. Field splicing of flighting sections shall be by full penetration welds done in strict accordance with the manufacturer's instructions using AWS certified welders.

E. The spiral flighting outside face shall be flat and smooth with round edges. The outside face shall be parallel with the flight centerline axis.

F. Spiral flighting shall be connected to the drive shaft using a flanged connection plate that shall be welded to the spiral on one end. Transition between the flighting and connection flange shall be smooth and fabricated to the tolerances listed below. The drive shaft shall have a matching mating flange and shall be bolted to the flight connection plate.

G. Flighting shall be formed accurately to the pitch required within ± 5/32-inch, with an average deviation of the pitch not exceeding ± 0.050-inch over the length of the conveyor. Flanged faces shall be machined to ± 0.001-inch perpendicular to the centerline axis of the screw. Screw pitch shall be measured at the outside diameter of the screw flights along four (4) straight lines parallel to the axial centerline of the spiral at 90° offsets and shall not vary more than ± 0.02 times the screw flight outside diameter from the design pitch.

H. The manufacturer is to repair, or replace, the spiral flighting not found in compliance with the aforesaid tolerances with new equipment until the spiral flighting meets the dimensional tolerance requirements. All refurbishment and payments necessary for ascertaining the dimensional tolerance of repaired or new replacement equipment shall be borne by the equipment manufacturer.

I. Shaftless flighting shall receive a shop coat of primer.

2.07 ACTUATED SLIDE GATE

A. The conveying equipment shall be provided with actuated slide gates on discharges as shown on the Contract Drawings and described below. Slide gates shall be designed for positive seating of gate blade when closed, to prevent dripping of material when closed.

1. Gates shall be designed with clear openings at least the width of the trough.

2. Gate design shall prevent solids from remaining in an opening after moving from the fully closed to the fully open position.

3. Construction material for the slide gate assembly shall be minimum 1/4" thick Type 316 stainless steel construction. Greater thickness shall be provided based on actual actuator thrust forces.

4. Slide rails shall be high wearing UHMW-PE, with machined groove for fit to gate blade.

5. Gate blade shall be a minimum 0.25” thick stainless steel. Greater thickness shall be provided based on head pressure.

6. The actuators shall have a rising stem with cover. Stem shall be stainless steel machine cut or rolled threads.

7. Entire gate assembly shall be designed to be attached to the equipment discharge, without a need for external attachments, bracing, or structure.

B. Actuated Slide Gates shall be electrically operated.

1. The conveyor manufacturer shall provide open/close service electric actuator in accordance with Section 40 05 58 – Gate Operators and Electric Gate Actuators.

2. Electric actuator shall be fixed to the gate frame, requiring no additional support.

3. Actuator shall be as specified and include internal limit switches for position reporting.

4. The actuator shall be rated for the specified environment, include internal adjustable limit switches, and a manual override hand wheel

5. The actuator shall be powered with 230/460V 3phase power and have integral controls to allow for switching to and controlling with local operation.

2.08 SAFETY DEVICES AND LIMIT SWITCHES

A. Safety Trip Cords

1. Each screw conveyor shall be furnished with emergency trip cords running on both sides of the conveyor and a safety stop switch in compliance with OSHA standards.

2. Trip cabling shall be 3/16-inch O.D. fabricated of internal 3/32-inch 7 x 7 strand galvanized aircraft cable and orange colored nylon outer sheathing. Cabling shall be supported by galvanized steel or chrome plated eyebolts every 10 feet. Wire clamps shall be stainless steel.

3. The switch assembly shall be able to handle up to 200 feet of conveyor length. Safety switch shall be housed in a NEMA 4X enclosure (aluminum, stainless steel or non-metallic) and shall have a DPDT micro-switch and stainless steel external hardware. Emergency trip cord and safety switch shall be Conveyor Components Company Model RS-1 or approved equal.

B. Zero Speed Switches

1. Provide non-contacting, proximity-type speed switch on screw conveyors to detect zero speed condition. The zero-speed switch shall consist of a sensor/pre-amplifier and an amplifier/output unit. The switch shall be located on the non-driven end of shafted conveyors.

2. The sensor/pre-amplifier shall utilize magnetic proximity effect to detect equipment rotational speed without physical connection to the rotating equipment. Sensors shall provide output pulses in proportion to rotational speed by detection of a ferrous target mounted on the rotating equipment for shaftless screw assembly and by detection of the rotating flights of a shafted screw assembly. The sensor shall operate satisfactorily with air gaps of up to 4”. The sensor/pre-amplifier shall be provided complete with mounting flange, threaded body, and locknut.

3. The amplifier/output switch unit shall provide two SPDT contacts that operate on detection of an under-speed operating condition. The SPDT contact outputs shall be rated for 5A at 120 volts AC. The unit shall include an adjustable start-up delay of 0 to 60 seconds to override zero speed alarm during initial acceleration. Units shall operate on 120-volt AC power. Provide set point adjustment range of 2 to 3,000 pulses per minute.

4. Zero speed detection switches shall be Milltronics MFA-4 with MSP-12 sensor/pre-amplifier or approved equal.

2.09 ELECTRICAL AND CONTROL REQUIREMENTS

A. Electrical Requirements

Conveyor Designation	SC-01
Motors	
Rating	460V, 3 ph, 60 Hz
Horsepower, maximum	10
Speed, rpm	1,800
Enclosure	TEFC
Insulation	Class F
Inverter Duty	No
Drive Type	Reversing
Service Factor	1.15
Space Heater	No
Motor Winding Temperature Switches	No
Separate Cooling Fan	No

A. Controls:

1. General:

a. Controls for the screw conveyor shall be furnished by the Conveyor manufacturer and shall include, but not limited to the vendor supplied Local Control Panel (LCP), programmable logic controller (PLC), operator interface terminal (OIT) if required, local control stations (LCSs), and instrumentation as required to provide a fully functional and complete system.

b. The conveyor control system shall be furnished by the conveyor manufacturer completely pre-wired, programmed and tested, requiring only mounting and connection to external wiring in the field.

c. The overall Control Strategy shall be as shown on the Process and Instrumentation Diagrams (P&IDs) and as described in Section 40 61 96 Process Control Descriptions. The controls and sequences described in Section 40 61 96 shall be taken as a general guideline of the required sequences and shall be modified and augmented by the conveyor vendor after submittal, review, and approval by the engineer. Additional control functions, interlocks, monitors, alarms, as determined to be necessary for safe and reliable operation shall be provided at the manufacturer’s discretion.

d. The vendor supplied PLC shall make provisions in both hardware and software for ethernet communications to the existing RTU-1 PLC using Modbus TCP/IP protocol, inputs and/or outputs to interface to the plant SCADA system as shown on the P&IDs and Section 40 63 43 Programmable Logic Controllers.

e. In addition to interface to the plant SCADA system, the vendor supplied PLC shall provide inputs/outputs as required to monitor and control downstream and associated equipment as required for overall system operation. The plant SCADA system shall provide monitor only facilities for operator information. For each type of hardwired input/output system, twenty-five percent spare input/output shall be provided to allow for future expansion of the PLC/SCADA interface.

f. At the conclusion of the project and acceptance for operation, the Conveyor vendor shall provide fully documented and extensively commented PLC ladder logic programming in their native formats for continued operation and maintenance of the systems. In addition, the vendor shall provide electronically printed documentation of the system for inclusion in plant archives and training materials.

g. Vendor supplied panels, panel devices, and construction shall conform to the requirements of the following Specification Sections:

1) Section 40 67 00 – Control System Equipment Panels and Racks

2) Section 40 78 00 – Panel Mounted Instruments

3) Section 40 78 56 – Isolators, Intrinsically-Safe Barriers, and Surge Suppressors

2. Vendor Supplied Local Control Panel:

a. Each screen shall be furnished with a Screen Vendor supplied LCP. The LCP shall be completely pre-wired and tested, requiring only mounting and connection to the interconnecting wiring in the field by the Contractor.

b. The LCP shall have NEMA 4X rated enclosure installed in the Electrical Room as shown on the Contract Drawings. The LCP shall be provided with PLC, panel mount devices, and VFD.

c. The LCP shall be constructed of type 304 stainless steel.

2.10 SPARE PARTS

A. Conveyor manufacturer shall provide the following spare parts for each size and type furnished.

1. One (1) speed reducer of each size
2. One (1) zero speed switch
3. One (1) safety trip cord switch
4. One (1) set of packing material for each conveyor.
5. One (1) complete set of trough wear liners (shaftless only)

B. Conveyor manufacturer shall provide any special tools required for servicing and/or maintenance of the screw conveyors.

PART 3 – EXECUTION

3.01 MANUFACTURER'S FIELD SERVICES

A. The services of a qualified manufacturer's technical representative shall be provided in accordance with Section 46 00 00 – Equipment General Provisions. For each series of conveyors, field services shall include the following site visits:

Service	Number of Trips	Number of Days/Trip
Installation and Testing	1	1
Startup and Training	1	1
Services after Startup	1	1

3.02 SHOP TESTING

A. Shop testing shall be in accordance with Section 46 00 00 – Equipment General Provisions.

3.03 FIELD TESTING

A. Preliminary and final field tests shall be performed in accordance with the requirements of Section 46 00 00 – Equipment General Provisions.

B. Preliminary Field Tests: Run 2-hour no load test on each screw conveyor. The test shall consist of the following:

1. Check starting and running amperage. Run for five (5) minutes.
2. If units operate vibration free and quietly with normal amperage, test is acceptable.

C. Final Field Test: Run a 16-hour test at plant highest available load conditions. Each conveyor shall be used in succession during this period. This test may occur either immediately following or totally separate in time from the Preliminary test. The testing program shall be considered complete when equipment operates satisfactorily and continuously without downtime for maintenance or repair for 16 hours split over two test periods of 8 hours each.

END OF SECTION

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